

SUSTAINABILITY, INNOVATION AND SOCIAL IMPACT

A COMPENDIUM OF GLOBAL RESEARCH STUDIES



Ángel Acevedo Duque

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Prologue

This work, entitled “*Sustainability, Innovation and Social Impact: A Compendium of Global Research Studies*,” constitutes a significant contribution to the contemporary academic debate surrounding three increasingly relevant pillars on the international agenda: sustainability, innovation, and social impact. Its purpose is not merely to bring together a set of contributions, but to offer a space for interdisciplinary and interregional convergence that articulates diverse perspectives on complex issues of global scope.

First, it is important to highlight the multidisciplinary nature of the volume, reflected in the breadth of fields addressed: economics, business management, tourism, archaeology, environmental studies, digitalization, and education, among others. This diversity is not simply a thematic compilation, but rather an interwoven network of approaches that fosters dialogue among disciplines traditionally considered separate, thereby enriching reflection and providing readers with a comprehensive framework for analyzing interconnected phenomena.

Across the volume, sustainability is positioned as a central category and guiding criterion. The studies included address issues such as the efficient management of water resources, solid waste management, tourism in rural areas, social entrepreneurship in vulnerable contexts, and the development of indicators for evaluating sustainability. These contributions are framed within contemporary debates surrounding the 2030 Agenda and enable a critical examination of the tensions and opportunities that arise in the pursuit of balance between economic growth, social equity, and environmental preservation.

At the same time, the work assigns a privileged place to innovation, understood not only as technological advancement but also as a tool for social and territorial transformation. In this regard, particular attention is drawn to studies applying emerging methodologies—such as scientometrics in the analysis of environmental commitment or the use of models—of machine learning in understanding the real estate market—illustrating the potential of innovation to generate new analytical frameworks and more efficient management practices.

The third pillar, related to social impact, is reflected in research demonstrating how scientific knowledge can contribute to improving living conditions in communities and territories. The comparative and international dimension of the studies—covering experiences in Chile, Spain, Indigenous communities in Colombia, Japan, and rural regions of Europe—gives the volume a distinctive scope, as it enables contrasts to be drawn, patterns to be identified, and cultural and structural particularities influencing outcomes to be highlighted. This global perspective strengthens the academic value of the work and makes it a relevant resource for analyzing the interaction between local dynamics and global processes.

Finally, the methodological diversity of the included works should be emphasized. The compendium integrates studies based on advanced quantitative analyses, econometric techniques, and projection models, alongside qualitative approaches that foreground the experiences and perceptions of local actors. It also incorporates hybrid methodologies that open new possibilities for research and knowledge transfer across different fields of application. This methodological plurality constitutes a key strength, providing the volume with both scientific rigor and practical relevance.

In summary, this book stands as an original and highly valuable contribution to the academic community, as well as to public policy-makers, the private sector, and civil society. Its emphasis on sustainability, innovation, and social impact—articulated through an interdisciplinary approach and a global perspective—makes it an essential reference for those seeking to understand and address the challenges of development in an interdependent and dynamic world.

What could be said about it?

It is worth noting that the work presents a set of characteristics that give it a distinctive voice compared to other existing publications. First, its strong multidisciplinary stands out, bringing together contributions from fields as diverse as economics, business management, tourism, archaeology, environmental studies, digitalization, and education. This diversity not only ensures a more comprehensive perspective on the phenomena analyzed, but also fosters dialogue among disciplines that usually remain isolated. Readers will encounter a mosaic of perspectives that, when interwoven, provide an integral understanding of complex issues requiring collaborative and intersectoral solutions.

Secondly, the work demonstrates a strong emphasis on sustainability and territorial development, two cross-cutting pillars that run through multiple contributions. Studies on water management, efficiency in solid waste management, tourism in rural areas, social entrepreneurship in vulnerable communities, and the development of sustainability indicators help articulate a contemporary debate that directly connects with the objectives of the 2030 Agenda. This orientation makes the book an essential reference for understanding how different disciplines and regions address the challenges associated with balancing economic growth, social equity, and environmental preservation.

An additional element that gives it distinctive value is its international and comparative scope. Unlike other compilations focused on a single country or context, this compendium includes research conducted in Chile, Spain, Indigenous communities in Colombia, Japan, and various rural regions of Europe. This global perspective not only enriches academic discussion, but also allows for contrasts to be drawn, common patterns to be identified, and cultural and structural singularities influencing outcomes to be highlighted. The comparative approach thus provides a robust framework for understanding the interaction between local factors and global dynamics.

Finally, it is worth emphasizing the broad methodological diversity characterizing the included works. The articles range from sophisticated quantitative analyses, employing econometric techniques and projection models, to qualitative approaches that

value the perceptions and experiences of local actors. Emerging and hybrid methodologies are also incorporated, such as scientometrics applied to the study of environmental commitment or the use of machine learning models to understand the real estate market. This methodological plurality not only strengthens the scientific rigor of the compendium, but also provides it with remarkable practical applicability, opening opportunities for both academia and public and private management.

In summary, this book is not merely a collection of articles, but a work that integrates multidisciplinary approaches, cross-cutting themes linked to sustainability, international perspectives, and innovative methodologies. These attributes make it an original and highly valuable contribution for researchers, policy-makers, business leaders, and readers interested in understanding the current and future challenges of development in an increasingly interconnected and complex world.

Analysis of business demographics in rural Europe

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Abstract

The growing importance of rural regions' economic development in the European Union's economic policy decisions highlights the need to study one of the most crucial factors in this development: rural entrepreneurial activity. Therefore, this work aims to understand the business dynamics that characterize European areas defined as urban and rural, and subsequently delve into the various types of rural areas according to their greater or lesser proximity to cities. This analysis is based on the study of the main business demographic indicators across several European countries: business creation and survival rates. These indicators make it possible to draw conclusions not only about entrepreneurial activity but also about the success rate and sustainability of business ventures. The results obtained provide a foundation for deeper analysis and will enable the generation of conclusions that support decision-making and the formulation of economic policy recommendations aimed at fostering rural development in Europe.

Keywords: Entrepreneurship, business demography, urban areas, rural areas, proximity.

1. Introduction

Over the past few decades, the process of rural depopulation has intensified. While this is a widespread trend across Europe, it has been more pronounced in certain countries, such as those in Eastern Europe and the Baltic States, as well as in Germany, Mediterranean and Southern countries like Greece, Portugal, Bulgaria, Romania, large parts of Spain, and some areas in Southern Italy, as highlighted in the ESPON 2020 report (2018).

This depopulation process is driven by various phenomena, including increased population longevity and related demographic behaviors, social habits, economic and technological development of regions, and infrastructure growth (Del Olmo & Garrido, 2024).

The aim of this study is to introduce the analysis of business dynamics and demography in Europe from a perspective that is gaining importance in economic policy: the distinction between urban and rural areas.

Undoubtedly, analyzing the demographic behavior of businesses will lead to a better understanding of the conditions in which they operate. This will facilitate the design of more appropriate economic policies to foster business development in rural areas and, ultimately, to stimulate economic growth and population attraction in these regions revitalizing a fundamental part of European territory.

In response to this situation, various strategies and economic policy measures have been implemented to improve economic, technological, and infrastructure development in order to attract population to the most depopulated areas (mainly rural) and thereby accelerate their development.

One of the most important strategies has been to promote entrepreneurial activity in rural areas (Del Olmo et al., 2023). In fact, rural areas present economic and structural characteristics that offer opportunities for entrepreneurs and can even be enhanced through the development of regional transformation networks (Barber et al., 2021). In this regard, scholars such as Steiner and Atterton (2015) conclude that rural entrepreneurship contributes to the local environment both directly—through job creation and the development of local products

and services—and indirectly, through secondary effects or the added value of primary business activities.

The literature (e.g., Gyimah and Lussier, 2021) indicates that rural entrepreneurs are different from other types of entrepreneurs, as they not only leverage local resources but also develop them, thereby boosting the local economy (addressing poverty, unemployment, and lack of economic growth). In fact, authors such as Pato and Teixeira (2018) argue that a rural entrepreneur should not only reside in the rural area but also be influenced by their social environment and have an impact on the local community. Along these lines, Korsgaard et al. (2015) distinguish between entrepreneurship in rural areas and rural entrepreneurship, noting that the former often entails limited local integration (usually for economic reasons), whereas the latter involves the use of local resources and helps reconnect spaces viewing rural areas as more than just sources of profit.

However, scholars such as López et al. (2019) point out a significant lack of entrepreneurship-based strategies in the most depopulated European regions.

In short, studying entrepreneurial dynamics is essential for understanding behavior and delving into the factors that determine success and therefore their contribution to the economic development of rural regions.

The goal of this study is to develop a general analysis of the main business demography indicators in Europe, distinguishing entrepreneurial behavior and business failure, and examining the differences between urban and rural areas. It also explores rural areas according to their proximity to cities.

The analysis is based on a descriptive study of the main available metrics related to business creation and survival, following methodologies previously used in the literature for the European context (Schrör, 2007; Schrör, 2009; Del Olmo, Crecente & del Val, 2019), as well as in specific countries such as Spain (Garrido, 2008; Garrido, 2008b; Herce et al., 2012; Crecente et al., 2014; Crecente et al., 2015).

Therefore, this is a general study aimed at laying the foundation for future research that will be more focused on understanding the causes behind the observed behaviors.

2. Data and Methodology

The growing interest in studying business dynamics within the European Union has led, in recent years, to the development of increasingly comprehensive official databases. In this regard, Eurostat's efforts have provided greater insight into the demographic behavior of businesses in both rural and urban environments further distinguishing, within rural areas, between those closer to urban centers and more remote zones.

This study uses data from the “Business demography by other typologies” statistics, which allows differentiation between urban and rural areas. Table 1 defines the main concepts used in this study.

Table 1: Concepts of urban and rural regions.

Concept	Definition
Predominantly urban region	Predominantly urban regions are part of the urban-rural typology, being NUTS level 3 regions where more than 80% of the population lives in urban clusters.
Predominantly rural region	Predominantly rural regions are part of the urban-rural typology, being NUTS level 3 regions where at least 50% of the population lives in rural areas.
Predominantly rural and remote regions	A predominantly rural region is considered remote if less than half of its residents can reach the center of a city with at least 50,000 inhabitants by car within 45 minutes.
Predominantly rural regions close to a city	A predominantly rural region is considered close to a city if more than half of the region's population can reach a city with at least 50,000 inhabitants.

Source: Eurostat

Likewise, to easily analyze the demographic behavior of European companies in these regions, the demographic indicators defined in Table 2 are used.

Table 2: Company demographic indicators.

Indicator	Definition
Birth rate (%)	Number of firms born in the reference period (t) divided by the number of active firms at t.
Surviving businesses	Number of firms born in t-3 that have survived until t.
Three-year survival rate (%)	Number of firms born in the reference period (t) at t-3 that have survived until t divided by the number of firms born in t-3.

Source: Eurostat

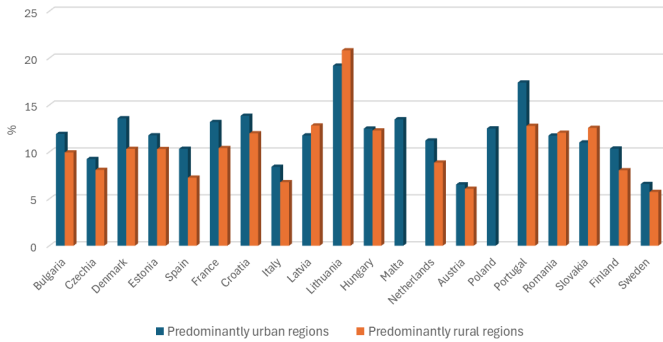
3. Business Demographics in European Rural Areas

A first approximation of the demographic reality of European businesses must begin with a characterization of entrepreneurial activity, that is, business creation.

The business start-up rate is a useful measure in this regard, as it allows us to see the proportion of businesses created in a particular year relative to the active business population in that year. However, the particular behavior of business dynamics during the pandemic makes it advisable to analyze the data for 2019 rather than 2020 (the latest available), given that the measures implemented to address the spread of the virus led to the paralysis of part of the economy and a historic drop in production, which naturally discouraged entrepreneurial spirit.

Figure 1 allows us to understand the business creation rate by distinguishing between predominantly rural regions and those characterized by urban areas.

Figure 1: Business Creation Rate (Urban VS Rural Regions) 2019.



Source: Eurostat data

It can be seen that most countries show higher business creation rates in urban areas. However, the cases of Romania, Slovakia, Lithuania, and Latvia are noteworthy, where entrepreneurial activity is primarily located in rural areas.

Looking deeper into the behavior of entrepreneurship in rural regions, Figure 2 allows us to distinguish between areas closer to urban centers and more remote areas.

Figure 2: Business creation rate (rural regions close to the city VS remote) 2019.



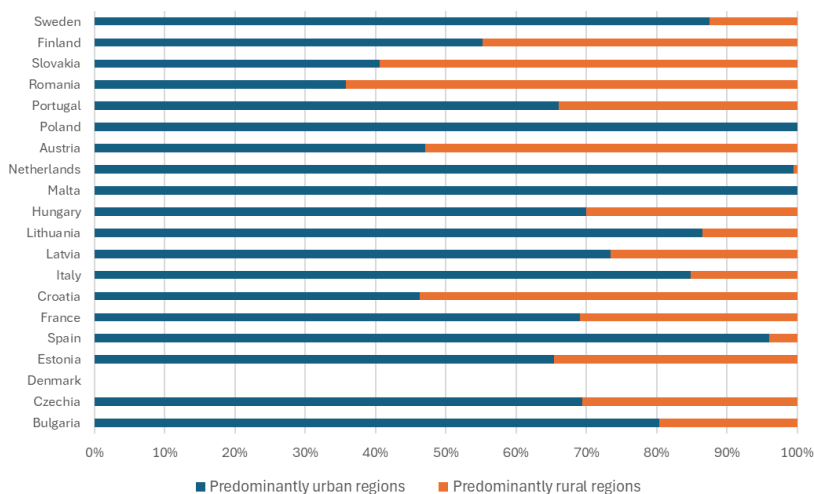
Source: Eurostat data

It can be observed that within rural entrepreneurial activity, most countries show greater entrepreneurial dynamism in areas closer to urban centers. However, some countries stand out for exhibiting more active entrepreneurial dynamics in remote rural regions namely Denmark, Croatia, Italy, Latvia, and Lithuania. Austria, Hungary, and Bulgaria also stand out for displaying very similar rates in both regional realities. Therefore, it is interesting to note that areas considered remote within rural regions do not necessarily present particularly limiting conditions for entrepreneurship. The aforementioned cases should be treated as references when implementing economic policies aimed at revitalizing rural environments.

Nevertheless, analyzing the absolute number of businesses created in the countries studied over time is an indicator that depends on each country's environmental factors (such as economic conditions, institutional frameworks, business financing conditions, or entrepreneurship-oriented culture, among others). However, relying solely on this indicator is insufficient, as it lacks sensitivity regarding the sustainability of entrepreneurial projects. Therefore, a more comprehensive indicator not only of entrepreneurial activity but also of its success is the number of companies that, having been created in year t , have survived over the following three years.

In this regard, Figure 3 provides insight into this information for both predominantly urban and predominantly rural regions in 2019. Although data is available for 2020, it must be remembered that this year displayed atypical behavior due to the impact of the pandemic. For this reason, and in the absence of post-pandemic data, the most recent data reflecting normal behavior unaffected by the COVID-19 pandemic shock has been used.

Figure 3: Companies born in t-3 that survived until t (urban vs. rural regions), 2019.



Source: Eurostat data

As shown in Figure 3, and as intended to be reflected, the quality of the data used still has room for improvement. For example, in the cases of Poland and Malta, there is no available data for predominantly rural areas, while in the case of Denmark, no information is available for this specific indicator. However, beyond the countries with missing information, very interesting conclusions can be drawn from the available data.

On the one hand, most countries show a higher number of businesses created (and demonstrating the ability to survive after three years) in urban areas compared to rural ones, with the Netherlands, Sweden, and Spain standing out in particular. However, although fewer in number, countries such as Slovakia, Romania, Croatia, and Austria stand out for showing the opposite pattern, where more than 50% of the businesses created and surviving during their first three years are located in predominantly rural regions.

When taking a closer look at the situation in predominantly rural regions, Figure 4 shows that in 2019, there are countries where more than 50% of the businesses created and surviving after three years

are located in areas far from cities such as Finland, Hungary, Latvia, Croatia, and Bulgaria.

Therefore, European countries show heterogeneous behaviors in terms of business creation dynamics from a regional perspective.

Furthermore, beyond the behavior of business creation dynamics in absolute terms, their survival and success rates should be analyzed, as this indicator helps understand the sustainability of entrepreneurial ventures.

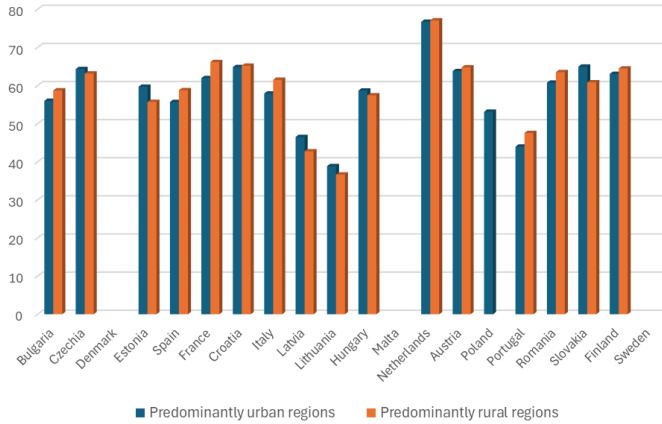
Figure 4: Companies born in t-3 that survived until t (rural regions close to cities vs. remote rural regions), 2019.



Source: Eurostat data

In this regard, Figure 5 allows us to appreciate the three-year survival rates of businesses in the analyzed countries, distinguishing between urban and rural areas.

Figure 5: Three-year business survival rate (%) (rural regions close to the city VS remote) 2019.



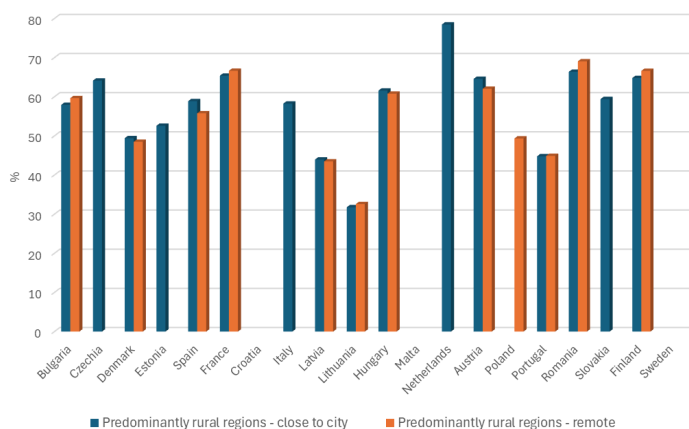
Source: Eurostat data

It can be seen that, in general terms, average three-year survival rates are close to 60%, although the Netherlands stands out with rates close to 75%, and, conversely, Portugal, Latvia, and Lithuania have the lowest rates, falling below 50% (not even 40% in Lithuania).

Likewise, higher survival rates are observed in rural areas in Bulgaria, Spain, France, Croatia, Italy, the Netherlands, Austria, Portugal, Romania, and Finland, which leads to greater resilience, either due to management and resources or due to the business model. On the other hand, in the other countries analyzed, greater survival capacity is observed in companies born in urban areas.

Looking more closely at rural areas, data is only available for 2020, which leads to their consideration with caution, given the pandemic environment that influenced business activity that year. However, in the absence of consistent data for 2019, this information remains invaluable for understanding the survival rate in different rural areas.

Figure 6: Three-year business survival rate (rural regions close to cities vs. remote ones) 2020.



Source: Eurostat data

A significant disparity in survival rates can be observed, with countries like France, Romania, and Finland showing three-year survival rates close to 70%, while others, such as Lithuania, barely exceed 30% in both segments. Moreover, no conclusive pattern emerges. Countries like Bulgaria, France, Lithuania, Romania, and Finland exhibit higher business survival rates in predominantly remote rural regions, whereas in the rest of the countries, entrepreneurial projects show higher three-year survival rates in rural areas closer to urban centers.

In summary, the analyses reveal differences in business dynamics, highlighting countries such as France, Italy, Portugal, Austria, Romania, Bulgaria, the Netherlands, and Finland. These countries not only exhibit significant rates of business creation in predominantly rural regions but also display distinctive medium-term survival patterns. This opens the opportunity to study the differential factors influencing this behavior and how they can be translated into economic policy recommendations.

4. Conclusions

The work presented provides a first approach to understanding the demographic behavior of European businesses from a perspective that remains uncommon in the business literature: the regional analysis of urban and rural areas. From this viewpoint, the study has aimed not only to understand the differences between both types of regions but also to delve deeper into the rural context by analyzing areas characterized by their proximity to or distance from urban centers.

The study highlights that most countries show relatively higher business creation rates in urban environments. However, it is important not to overlook the cases of Romania, Slovakia, Lithuania, and Latvia, where entrepreneurial activity is mainly located in rural areas. In fact, when analyzing predominantly rural territories more deeply, most countries show greater entrepreneurial activity in areas closer to cities. Yet, countries like Denmark, Croatia, Italy, Latvia, and Lithuania stand out for exhibiting more active entrepreneurial dynamics in remote rural regions.

From the perspective of entrepreneurial project survival, there is a higher survival rate in rural areas in countries such as Bulgaria, Spain, France, Croatia, Italy, the Netherlands, Austria, Portugal, Romania, and Finland. Within rural zones, countries like Bulgaria, France, Lithuania, Romania, and Finland show higher business survival rates in predominantly remote rural regions, while in the rest of the countries, three-year survival of entrepreneurial projects is higher in rural areas closer to urban centers.

As stated from the beginning, the analysis presented is a preliminary approach to the reality of business demography from the perspective of rural areas in Europe. However, a more in-depth analysis is required to understand this reality from a sectoral perspective and with greater analytical depth, also considering business size.

Therefore, this line of research will be pursued in future studies to obtain robust conclusions that can inform economic policy recommendations aimed at better understanding the business landscape in rural Europe and, ultimately, promoting economic development and repopulation of rural areas.

5. Bibliography

- [1] Barber III, D., Harris, M.L., Jones, J. An overview of rural entrepreneurship and future directions. *Journal of Small Business Strategy*. 2021; 31 (4): 1–4. DOI: <https://doi.org/10.53703/001c.29468>
- [2] Crecente, F.J., Martos, E. I. y Rivera, L. F. Análisis de la demografía empresarial de las regiones españolas: Evolución y fuentes. Paper presented at: XI International Conference on Regional Science. 2014 Nov 20-21; Zaragoza, Spain.
- [3] Crecente, F. J., Martos, E. I. y Rivera, L. F.: Evolución de la demografía de los empresarios autónomos en las regiones españolas: el germen del emprendimiento. Paper presented at: XLI International Conference on Regional Science. 2015 Nov 18-20; Reus, Spain.
- [4] Del Olmo, F., Crecente, F. y Del Val, M. T. Dynamic analysis of business demography strategy: An European perspective, *Journal of Small Business Strategy*. 2019; 29 (1): 16-29. [Consulted 6 Jun 2025]. Available at: <https://libjournals.mtsu.edu/index.php/jsbs/article/view/1355>
- [5] Del Olmo, F., Domínguez, I., Crecente, F. y Del Val, M. T. Determinant factors for the development of rural entrepreneurship, *Technological Forecasting and Social Change*. 2023; 191, 122487: 1-14, DOI: <https://doi.org/10.1016/j.techfore.2023.122487>
- [6] Del Olmo, F. y Garrido, R. Longevidad, envejecimiento de los territorios y despoblación rural en España: propuesta de política económica, in Barac & Rohr (coord.). *Política Económica 2022*. Valencia; Tirant lo Blanch. 2024. p. 105-134.
- [7] ESPON. Luchando contra la despoblación rural en el sur de Europa, ESPON. 2018. [Consulted 6 Jun 2025]. Available at: https://www.espon.eu/sites/default/files/attachments/af-espon_spain_02052018-sp.pdf
- [8] Garrido, R. La dinámica empresarial en España. Un enfoque territorial. Madrid; Fundación EOI. 2008. [Consulted 6 Jun 2025]. Available at: <https://www.eoi.es/sites/default/files/savia/documents/componente12036.pdf>
- [9] Garrido, R. La dinámica empresarial en España. Un enfoque sectorial. Madrid; Fundación EOI. 2008b. [Consulted 6 Jun 2025]. Available at: <https://www.eoi.es/sites/default/files/savia/documents/componente12033.pdf>
- [10] Gyimah, P., Lussier, R.N. Rural entrepreneurship success factors: an empirical investigation in an emerging market. *Journal of Small Business Strategy*. 2021; 31 (4): 5–19. DOI: <https://doi.org/10.53703/001c.2947>
- [11] Herce, J. A. et al. *Emprender en momentos de crisis. Riesgos y factores de éxito*. Madrid; Fundación Mapfre. 2012. [Consulted 6 Jun 2025]. Available at: <https://app.mapfre.com/ccm/content/documentos/fundacion/cs-seguro/informes/emprender-en-momentos-de-crisis-riesgos-factores-exito.pdf>
- [12] Korsgaard, S., Müller, S., Wittorff Tanvig, H. Rural entrepreneurship or entrepreneurship in the rural – between place and space. *International Journal of Entrepreneurial Behavior & Research*. 2015; 21 (1): 5–26. DOI: <https://doi.org/10.1108/IJEBR-11-2013-0205>
- [13] López, M., Cazorla, A., Panta, M.P. Rural entrepreneurship strategies: empirical experience in the northern sub-plateau of Spain. *Sustainability*. 2019; 11, 1243. DOI: <https://doi.org/10.3390/su11051243>

- [14] Pato, L., Teixeira, A.A.C. Rural entrepreneurship: the tale of a rare event. *Journal of Place Management and Development*. 2018; 11 (1): 46–59. DOI: <https://doi.org/10.1108/JPMD-08-2017-0085>
- [15] Schrör, H. Business demography: growth in the population of enterprises, *Eurostat Statistics in focus*. 2007; 48/2007: 1-8.
- [16] Schrör, H. Business Demography: employment and survival, *Eurostat Statistics in focus*. 2009; 70/2009: 1-8.
- [17] Steiner, A., Atterton, J. Exploring the contribution of rural enterprises to local resilience. *Journal of Rural Studies*. 2015; 40: 30-45. DOI: <https://doi.org/10.1016/j.jrurstud.2015.05.004>

Analysis of public spending to improve the residential rental market

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Abstract

The residential rental housing market in Spain has been affected by the lack of housing supply and the increase in average rents. For this reason, public administrations have allocated public resources and other instruments in an attempt to influence this market. However, despite the efforts and initiatives undertaken, the objectives set out in the programs approved in public budgets have not been achieved. This has occurred for several reasons, among which stands out the systematic use of regulations and applicable legislation to compensate for the lack of resources allocated to this policy. Rather than being effective, past experiences have shown the inefficiency of these regulations, particularly in relation to rent control. Additionally, the subsidies and financial aid derived from programmatic and financial instruments intended to benefit either landlords or tenants—have led to an increase in rental values. When combined with the implementation of measures aimed at reducing tax benefits, this has resulted in a rise in tax revenue. Therefore, a responsible debate on housing policy must be undertaken.

Keywords: Housing policy, rental market, public spending.

1. Introduction

This paper presents a descriptive analysis of public spending and the instruments used by housing policy during the period 2008–2025 to achieve its objectives in the residential rental market—namely, increasing the supply of rental housing and containing average rental prices to improve housing accessibility in Spain.

Following the Global Financial Crisis (GFC), housing policy abandoned measures related to homeownership and redirected its regulatory efforts and public spending toward rental housing as the preferred tenure system to address housing accessibility issues, particularly among the most disadvantaged social groups (Van-Halen, 2016). This shift is reflected in the objectives and programs of the State Housing Plans approved since 2013 by the central government and the Autonomous Communities (CC.AA.) under the common tax regime (all except the Basque Country and Navarre), which, among other goals, aimed to intervene in the rental market to improve the housing stock and contain rent prices.

Among the tools used by Spanish authorities, regulatory legislation has prevailed. The existing literature highlights critical perspectives based on national and international experiences (Marsh et al., 2022), warning of the unintended consequences of regulatory initiatives such as rent control in the rental market (Gómez, 2023; Harrington et al., 2023; Kholodilin & Kohl, 2023; Pareja & Sánchez, 2022).

Another notable intervention mechanism is public spending through grants and subsidies (Blanco et al., 2024; López, 2019), although some authors have raised concerns about potential negative externalities in this area (Ferri & Herranz, 2023; Gómez, 2023), and empirical evidence suggests that such subsidies may be passed on to rent prices in a context of high demand and rigid supply, as is the case in Spain's residential rental market (Banco de España, 2024; Valverde, 2024).

Given the above, this paper analyzes the use of different instruments and public resources dedicated to this policy, aiming to provide information for decision-making by political authorities.

Thus, the article contributes to the ongoing debate on improving housing accessibility in Spain.

The paper is structured into five sections. Following the introduction, the second section describes the instrumental framework of the adopted initiatives, including regulatory, fiscal, programmatic, and financial measures. The third section reviews the use of public resources included in the General State Budgets. After these descriptions, a brief reflection and recommendations are presented, and the fifth and final section offers conclusions based on the analysis in the previous sections, which are deemed necessary to foster the debate on this policy.

2. Housing Policy Instruments

The implementation of housing policy involves the use of various instruments, which, whether applied individually or simultaneously, should enable the achievement of the objectives set for any public policy. To facilitate the required analysis, Table 1 lists the instruments under study, which will be detailed in the following sections.

Table 1: Summary of Housing Policy Instruments Aimed at the Rental Market.

INSTRUMENTS	DEFINITION
Regulatory	Binding legal regulations of direct application: - Civil Code - Urban Leasehold Law - Law on the Right to Housing
Programmatic	General State Budget: Access to Housing and Construction Promotion - Program 261N: Promotion, administration, and assistance for rehabilitation and access to housing (State Housing Plans) - Other programs (Youth Rental Bonus)
Financial	General State Budget: Access to Housing and Building Promotion - Next Generation EU Funds: Resilience and Recovery Mechanism (Recovery, Transformation, and Resilience Plan)
Tax	Tax relief for tenants and homeowners

Source: Own elaboration.

Normative or regulatory instruments consist of binding legal rules with direct applicability. It is common for the State, as the creator of such regulations, to enact them with the intention of intervening in specific issues, such as rent control in the rental market (Arruñada, 2022; Collado et al., 2021; Fuente, 2023; Harrington et al., 2023; Marsh et al., 2022).

On the other hand, programmatic measures establish concrete actions based on the political strategy that determines specific objectives, resource allocation, and their validity over a set period. Financial instruments are usually linked to programmatic ones and are used to economically stimulate public and private activity through financial support (Independent Authority for Fiscal Responsibility (AIReF), 2023).

Finally, fiscal policy instruments aim to incentivize and improve the income of individuals and legal entities, seeking to make rental investments attractive. However, this comes at the cost of reduced tax revenue (AIReF, 2020).

2.1. Normative instruments for residential rental housing policy

Following Constitutional Court Ruling 152/1988, which outlined the distribution of competencies between the State and the Autonomous Communities (CC.AA.), the latter assumed the design, coordination, and management of programmatic and financial instruments established in the State Housing Plans (PEV) through collaboration agreements between different Public Administrations (AA.PP.) and financial entities. Meanwhile, the State issued legislation as an economic policy instrument aimed at intervening in, regulating, and organizing all aspects of housing policy, through binding legal norms applied directly.

It is important to exclude from these instruments any legislation used to legitimize the development of other related programmatic and financial instruments, such as the approval of agreements between CC.AA. and the State, accompanied by the allocation of budgetary resources for each PEV.

Regarding the rental housing market, the current reference regulations at the national level include the Royal Decree of July 24, 1889, which enacted the Civil Code, Law 29/1994 of November 24 on Urban Leases (LAU), and Law 12/2023 of May 24 on the Right to Housing.

The first regulation appears in the Civil Code under Title VI “On the lease contract”, specifically Articles 1546 to 1582 in Chapter II “On rural and urban property leases”. These provisions govern leases and aspects not covered by the LAU and offer a broader perspective on various implications and conditions related to renting.

The current LAU, Law 29/1994 of November 24, on Urban Leases, had its first legislative reference in Decree 4104/1964 of December 24. It has undergone numerous amendments, the most recent being Law 4/2013 of June 4, on measures to make the housing rental market more flexible and to promote it, which, among other things, establishes the general framework for conditions in lease agreements; and Royal Decree-law 7/2019 of March 1, on urgent measures in housing and rental matters. This decree not only modified several articles of Law 29/1994, but in its first additional provision it expressly mentions the “Redirection of the State Housing Plan, which should exclusively support housing under rental tenure”. Additionally, its second additional provision establishes the State System of Rental Price Reference Indexes (SERPAVI), which would later serve as a benchmark for rent control.

Lastly, Law 12/2023 of May 24 on the Right to Housing is directly related to the implementation of Spain’s Recovery, Transformation, and Resilience Plan (PRTR), stemming from the Recovery and Resilience Mechanism (MRR), and more specifically, with milestone C2.R3 “Housing Law”, listed as number 22 in Annex B.2. concerning non-reimbursable financial aid of the Council’s Implementing Decision of June 16, 2021, approving the PRTR. In addition to including programmatic and financial measures, one of the objectives of this law is to contain rent increases, which it addresses through the regulation and control of average rental prices in stressed areas.

The application of Law 12/2023 regarding rent control required the publication in the Official State Gazette (BOE) of the municipalities that each Autonomous Community considered as “stressed residential

market areas”, where the Reference Rental Price Index of the State System for Rental Price Reference (SERPAVI) would be applied.

Among all the Autonomous Communities, only the Generalitat of Catalonia published in the first quarter of 2024 a list of 140 municipalities, later updated in October 2024. The rest voluntarily chose not to designate their stressed areas. Their decision was based on arguments that such regulations might have adverse effects contrary to their intended purpose. International experiences suggest that, although effective in the short term within the regulated segment, these measures could raise rents in the unregulated market, leading to medium-term practical difficulties in implementation and supply response. Thus, they could ultimately hinder solutions to the rental housing market’s problems. Therefore, this decision rendered the nationwide application of this law ineffective.

2.2. Programmatic and financial instruments used in housing policy in Spain

Since the enactment of the “Royal Decree 1932/1991 of December 20 on financing measures for protected housing actions under the 1992–1995 Plan”, following the 1988 Constitutional Court Ruling, and for six consecutive PEVs, the programs saw little change (Gómez, 2023; Van-Halen, 2016). Public resources primarily focused on promoting the construction of new protected housing for ownership and rental, seen as both savings and investment, as well as a way to stimulate the construction sector (Castaño, 2012).

In 2007, the Basic Youth Emancipation Income (RBE) was approved to facilitate young people’s emancipation, boost labor mobility, and stimulate the rental market. It consisted of direct subsidies to cover rent for one’s habitual and permanent residence. The program was repealed on January 1, 2012. That year, the aid amount was reduced from €210 to €147 for those whose rights had been recognized or who had applied before that date, and was available until they turned 30 or had received it for its full four-year term.

Between 1992 and 2012, in terms of direct rental subsidies, only this RBE program, approved in late 2007 and active from 2008 to 2012, showed positive results. This was both in terms of the number of young

beneficiaries and the increased probability of emancipation linked to income rise (Aparicio & Oppedisano, 2012). Nevertheless, the program faced complaints and criticism, particularly over its cancellation and delays in disbursing the aid, due to limited credit availability for new applications and coordination issues between CC.AA. and the State during application processing (Ombudsman, 2013).

Despite the RBE, Spain showed a clear lack of initiative in developing the private and social rental markets (Castaño, 2012), until a turning point in 2013. That year, income tax deductions for home purchases were eliminated for buyers who acquired their main residence after January 1, 2013. Likewise, programs under PEVs aimed at homeownership acquisition were discontinued, redirecting resources toward promoting the residential rental housing market through the enactment of “Royal Decree 233/2013 of April 5 regulating the State Plan for the Promotion of Housing Rentals, Building Renovation, and Urban Regeneration and Renewal, 2013–2016” (PEV 2013–2016). The title itself served as a declaration of intent.

The 2013–2016 PEV established eight programs, two of which were aimed at the rental market. One was a rental assistance program intended to facilitate access to and retention of rental housing for economically disadvantaged groups. It required beneficiaries’ income not to exceed three times the IPREM and monthly rent to be €600 or less. A second rental-focused program aimed to promote a stock of protected rental housing, creating a public rental housing stock on publicly owned land or buildings, with a surface area not exceeding 90 m², intended for rotation or protected use.

The 2018–2021 State Housing Plan (PEV) seeks to give new momentum to the promotion of rental or leasehold housing, whether through public or private initiatives. Of the initial nine programs, which were later expanded due to the COVID-19 crisis, four were aimed at providing rental assistance.

Lastly, the current State Plan for Access to Housing 2022–2025, which comprises 13 programs, includes four that offer direct assistance to tenants, with special attention to certain vulnerable groups, and another five aimed at boosting the supply of rental housing by increasing the public housing stock and promoting the development of affordable or social rental housing.

Table 2: Programs directly related to the residential rental housing market under the PEV 1992–2025.

STATE HOUSING PLANS (SHP)	PROGRAMS TO BOOST SUPPLY	PROGRAMS TO STIMULATE DEMAND
SHP 1992 - 2012	• Newly built social housing for rent • Co-financing of publicly promoted social housing for rent • Renovation of rental housing • Purchase of used rental housing • Aid for owners of unsubsidized rental housing	• Basic Emancipation Income (2008-2012) • Tenant Assistance
SHP 2013-2016 (Prórroga 2017)	• Promotion of public rental housing stock	• Housing rental assistance
SHP 2018-2021	• Promotion of rental housing stock • Promotion of housing for seniors and people with disabilities (rental or transfer of use)	• Rental assistance
		• Assistance for people facing eviction or foreclosure from their primary residence
		• Assistance for young people (under 35 years old)

STATE HOUSING PLANS (SHP)	PROGRAMS TO BOOST SUPPLY	PROGRAMS TO STIMULATE DEMAND
SHP 2022-2025	• Increase in the public housing stock • Promotion of housing for seniors or people with disabilities • Promotion of temporary accommodation, cohousing models, intergenerational housing, and similar modalities. • Provision of SAREB and public entity housing for rental as social housing. • Promotion of making available to autonomous communities and city councils free housing for rental as affordable or social housing. • Assistance with the payment of rental income protection insurance.	• Youth Rental Bonus • Rental assistance • Assistance for victims of gender-based violence, people facing eviction from their primary residence, the homeless, and other particularly vulnerable people • Assistance for tenants in situations of sudden vulnerability • Assistance for young people and to help address the demographic challenge

Source: Own elaboration

From Table 2, it can be seen how, over time, the number of programs related to rental housing within each State Housing Plan (PEV) has increased, becoming increasingly specific in defining the target beneficiaries of the aid, with particular attention to distinguishing among groups considered to face greater accessibility challenges. This segmentation allows for the allocation of a budget to each identified issue, with access conditions tailored and differentiated according to the various groups. In this way, the aim is to ensure both

the availability and appropriate allocation of resources based on a better assessment of the beneficiaries.

Therefore, for each program in each PEV, the granting of aid is subject to the fulfillment of a series of requirements established by the regulations for both public and private beneficiaries. Personal, family, and income characteristics affect the intensity and amount of aid that may be granted, whether in the form of loans, subsidies, or grants.

On the other hand, it is important to consider that a greater number of programs necessarily leads to an increase in the bureaucratic and administrative management of the entire PEV. In accordance with Law 39/2015 of October 1, on the Common Administrative Procedure of Public Administrations, each Autonomous Community must publish the corresponding call for each program in its Official Journal, establishing a specific application period during which potential beneficiaries may voluntarily—rather than automatically—submit their application and the required documentation. This process initiates a case file that may lead to all kinds of requests for documentation, clarifications, or appeals, ending with either the approval or denial of the requested aid, often after several months or even years of processing.

2.3. Details of Financial Instruments for Boosting the Supply of Residential Rental Housing in the PEV 2022–2025

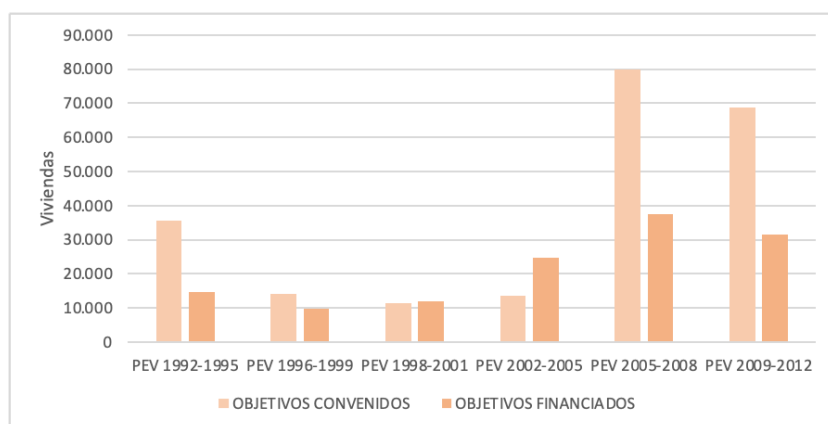
Public sector financial instruments are used as countercyclical tools to stimulate supply during periods of credit constraints, as well as to address structural market failures (AIReF, 2023).

With the approval of the European Recovery and Resilience Mechanism (RRM) funds under the Next Generation EU (NGEU) through the Recovery, Transformation and Resilience Plan (PRTR) (Government of Spain, 2023), special emphasis is placed on financing the initiatives included in Component 2, titled “Implementation of the Spanish Urban Agenda – Urban Rehabilitation and Regeneration Plan”. Among its financial instruments are C02.I02, “Program for the construction of social rental housing in energy-efficient buildings”, and C02.I07, “ICO loan line for the promotion of social housing”,

which aim to increase the stock of social or affordable rental housing through rehabilitation and new construction programs (Government of Spain, 2023). In Spanish regulations, these measures are applied through Program 6 of Royal Decree 853/2021 of October 5, which regulates aid programs for residential rehabilitation and social housing under the PRTR.

Regarding the market failures these financial instruments aim to correct—as noted in the Component 2 Addendum of the PRTR (Government of Spain, 2023)—on one hand, there has been insufficient private financing for the development of rental housing, and on the other, there is a need to ensure the full implementation of government-approved subsidies. This is particularly to avoid repeating what occurred during the 1992–2012 period, when initiatives focused on boosting the supply of subsidized rental housing under the PEV, using this type of financial instrument, fell significantly short of expectations, achieving less than 60% of the set objectives, as shown in the following chart.

Figure 1: Fulfillment of Objectives within the PEV for the Construction of Subsidized Rental Housing, 1992–2012.

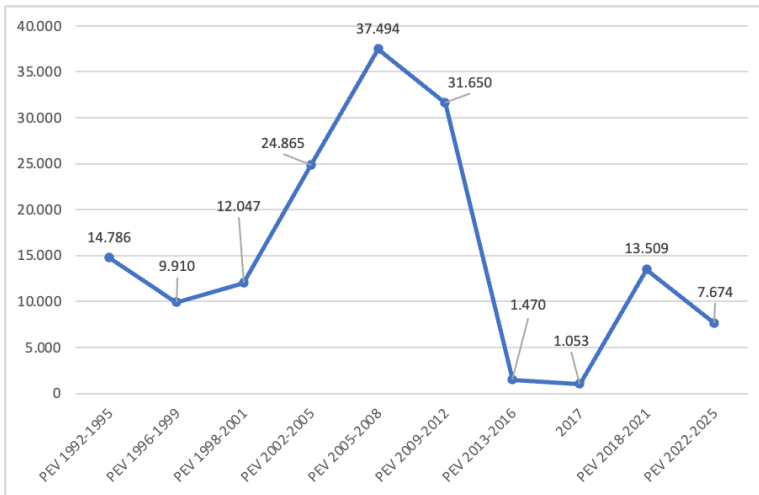


Source: Van Halen, 2016

If the results during the 1992–2012 period had already fallen short of expectations, then during the 2013–2023 period, the construction of subsidized rental housing became nearly symbolic. Although the State Housing Plans (PEVs) continued to include programs aimed at

boosting supply—and even with the arrival of NGEU funds starting in 2021—the reality is that their impact on construction levels was negligible, accounting for only 2.6% of all newly built housing, both market-rate and subsidized. This highlights their inability to influence the supply of residential rental housing, let alone rental prices.

Figure 2: Newly Built Subsidized Housing Intended for Rental, 1992–2023.



Source: Ministry of Transport and Sustainable Mobility (MTMS)

Note: Data from the 2022–2025 State Housing Plan (PEV) available up to 2023.

2.4. Fiscal Instruments

Tax benefits are amounts not collected by the State and left in the hands of the beneficiaries through the use of fiscal policy tools aimed at achieving specific economic and social goals. These tools operate via reductions, deductions, and rebates that create incentives or improve the income of beneficiaries (Independent Authority for Fiscal Responsibility—AIReF, 2020). In the case of the rental market, they have been used both on the demand side (with reductions for landlords) and the supply side (with deductions for tenants).

Regarding fiscal tools to promote supply, Law 35/2006, of November 28, on Personal Income Tax (IRPF), in Article 23.2,

established a reduction for income generated from renting real estate intended for housing. This provision has been amended four times since its approval. Originally, it allowed for a 50% general reduction on rental income, which increased to 100% if the tenant was between 18 and 35 years old and had net earned income exceeding the IPREM (Public Indicator of Multiple Effect Income) in the tax year.

The first amendment, effective January 1, 2011, increased the general reduction to 60% and lowered the maximum tenant age to 30 years.

The second amendment, effective January 1, 2015, maintained only the general 60% reduction, eliminating the extra benefit for young tenants.

The third amendment, effective July 11, 2021, specified that the 60% reduction would only apply to positive net rental income declared voluntarily by the taxpayer before the start of a data verification, limited audit, or tax inspection process involving such income.

The most recent amendment—Law 12/2023, of May 24, on the Right to Housing—currently governs the tax treatment of rental income. It is directly related to the implementation of Spain's Recovery, Transformation, and Resilience Plan (PRTR), stemming from the Recovery and Resilience Mechanism (RRM), and more specifically with milestone C2.R3 “Housing Law”, listed as item 22 in Annex B.2. of the Council Implementing Decision of June 16, 2021 approving the PRTR.

Among the goals of this law is to contain rent increases, and it includes both programmatic and financial measures. It stands out for regulating rents in stressed housing markets, setting the following reduction percentages:

90% reduction for new rental contracts in stressed residential areas, where the initial rent has been reduced by more than 5% compared to the previous rent for the same unit, adjusted for any annual rent updates under the previous contract.

70% reduction if the taxpayer rents the dwelling for the first time in a stressed area and the tenant is aged 18–35, or if the tenant is a public administration or nonprofit organization using the unit for social housing below the threshold set in the national housing plan, or

to house individuals in economic vulnerability, or if the unit is part of a public housing program limiting rent levels.

60% reduction if the unit underwent rehabilitation completed within the two years prior to signing the lease.

A 50% general reduction in all other cases, maintaining the requirement that no verification or inspection process has been initiated.

To benefit from these reductions under the IRPF, just like with rent control measures, each Autonomous Community (CC.AA.) must designate the municipalities in “stressed residential markets.” As noted, only the Generalitat of Catalonia published such a list (140 municipalities, Q1 2024), while the rest of the regions chose not to, effectively nullifying the law’s national application and reducing general fiscal benefits from 60% (prior to the law) to 50% for eligible landlords.

Reducing the IRPF tax base is aimed at boosting housing supply. An increase in beneficiaries suggests a growing rental supply, which in turn caused a nearly proportional rise in fiscal benefits, albeit with a decline and later stabilization of the average benefit per taxpayer, as seen in the previous table. However, per Article 45 of the IRPF Law, subsidies received by tenants are not tax-exempt, being classified as capital gains for tax purposes. Meanwhile, landlords declare rental income, applying the relevant reduction, and both tenants and landlords see an increase in their general tax base, meaning the State recovers part of the granted subsidies and benefits.

The reduction of tax benefits related to rental demand is due to Article One, Paragraph 48 of Law 26/2014, which repealed Article 68.7 of the IRPF Law. That article had regulated the deduction for renting a primary residence, but was repealed for contracts signed after January 1, 2015, leaving no national-level deduction for tenants, with only regional deductions available at the discretion of each CC.AA.

For legal entities (companies) that own rental housing:

Article 10.3 of Law 27/2014, of November 27, on Corporate Income Tax (IS), stipulates that subsidies must be recorded as income directly allocated to net equity and reported in the profit and loss statement.

Articles 48 and 49 of the same law govern corporate tax deductions for entities renting eight or more units for at least three years. Initially, these entities were eligible for an 85% tax deduction, which was later reduced to 40% under Law 22/2021, of December 28 (General State Budget for 2022).

Despite this reduction, the strong increase in qualifying entities shows the momentum of the rental housing market. These entities must formally notify the tax authorities in order to claim the benefit.

Table 3: Details of Tax Benefits Obtained in 2013 and 2023 Related to Residential Rental Housing.

	Reduction in the owner's personal income tax base		
	Millions of euros	Beneficiaries	Euros/Beneficiary
2013	463,07	976.843	474,05
2023	716,61	2.033.555	352,39
	Deduction for renting a habitual residence in the tenant's state personal income tax (IRPF)		
	Millions of euros	Beneficiaries	Euros/Beneficiary
2013	140,83	722.299	194,97
2023	29,74	147.690	201,37
	Bonus on the full IS tax rate for entities		
	Millions of euros	Beneficiaries	Euros/Beneficiary
2013	20,23	449	45.055,68
2023	29,09	1.509	19.277,67

Source: *Tax Benefits Report*.

Summary

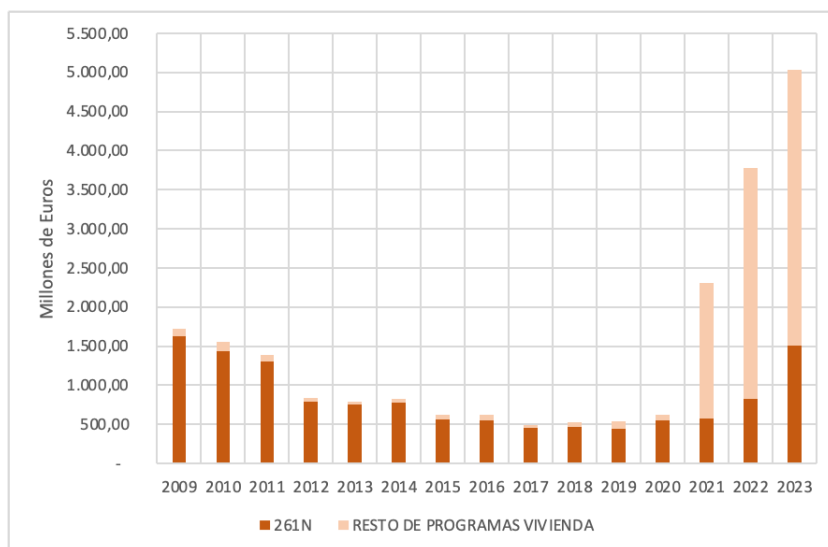
The fiscal incentives aimed at boosting supply and stimulating demand in the residential rental market during the analyzed period have mostly declined. For instance, the reduction in the taxable base for property owners decreased from 60% in 2023 to 50% in 2024, and the tax rebate on the corporate income tax for entities engaged in rental activities dropped from 85% in 2021 to 40% in 2022. In some cases, such as state-level deductions for tenants, they even disappeared completely in 2015.

As previously noted, the reduction in tax benefits results in higher tax revenue for the State. Combined with the increase in rental income for property owners and capital gains for tenants, housing policy has increasingly become a revenue-driven policy.

3. Instruments Aimed at Influencing the Rental Market in the General State Budget

Housing policy in Spain, within the framework of the General State Budget (PGE), is referred to as “Access to Housing and Promotion of Building.” According to the program classification indicating how public spending is allocated, the most budget-relevant component of housing policy is Program 261N, titled “Promotion, Administration and Assistance for Rehabilitation and Access to Housing.” In fact, as shown in Figure 3, it can be stated that until the approval of the Next Generation EU (NGEU) Funds in 2021, Program 261N accounted for over 90% of the national funds allocated each year to promote and implement housing policy in Spain. This program includes the subsidies and grants outlined in the State Housing Plans (PEV) for each Autonomous Community (CC.AA.), which include assistance related to residential rental housing.

Figure 3: Evolution of the Housing Policy Budget in Spain, 2009–2023.



Source: *Economic and Financial Report. General State Budget (PGE)*

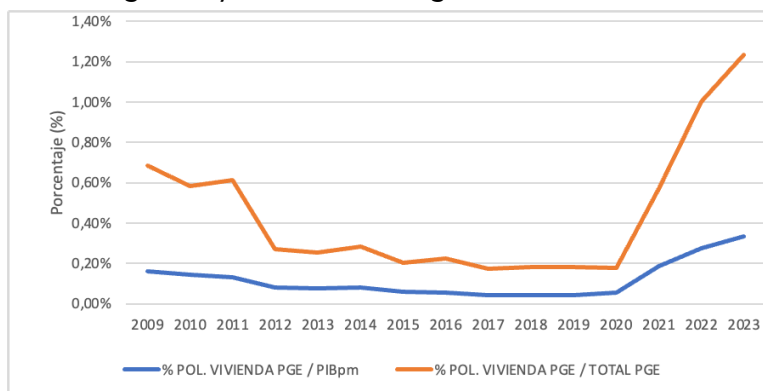
However, there has been a strong and continued decline in Program 261N, initially coinciding with the Global Financial Crisis (GFC) and the sovereign debt crisis. It did not recover despite positive signs in the Spanish economy from 2014 onwards, reaching its lowest levels between 2018 and 2020.

According to the 2021-2024 Stability Program Update (Ministry of Economic Affairs and Digital Transformation, 2024), starting in 2021, after the COVID-19 crisis, the government's optimistic forecasts led to a more than 20% increase in public spending in the PGE - 2021 compared to the previous year (Sanz & Romero, 2021). From that moment, a rapid growth trajectory for housing policy began between 2021 and 2023, reaching a volume of domestic resources higher than those available ten years earlier, although not yet reaching the levels seen prior to the GFC.

At the same time, in 2021, the European funds from the Resilience and Recovery Mechanism (MRR), part of the NGEU Funds, were approved through the Recovery, Transformation, and Resilience Plan (PRTR) (Government of Spain, 2023). These funds came to represent 75% of the housing policy budget for the period 2021-2023. In the case of housing policy, they are part of Component 2, titled "Implementation of the Spanish Urban Agenda - Housing Rehabilitation and Urban Regeneration Plan."

Regarding the representation of the budget allocated to housing policy, as shown in Figure 4, for the period 2009-2023, both the limited relevance of public resources allocated to this policy and the decline in its relative weight are evident, even taking into account the effect of the NGEU Funds.

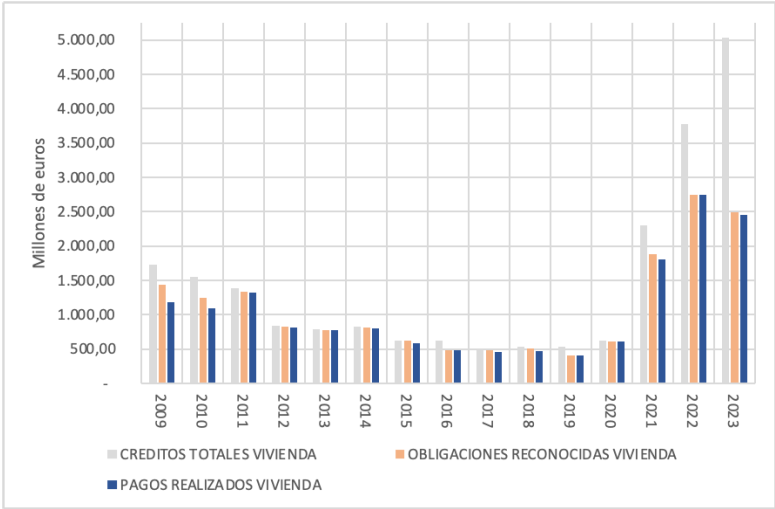
Figure 4: Evolution of the Relative Weight of Resources Used in Housing Policy as a Percentage of GDP and Total PGE.



Source: *Economic and Financial Report. General State Budget (PGE)*

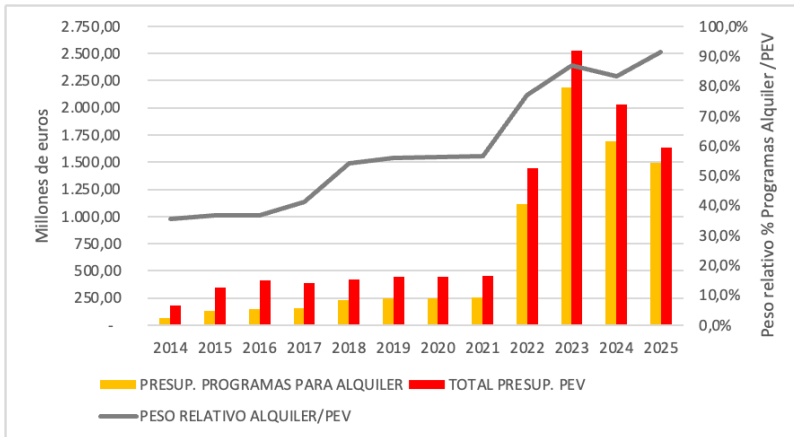
Regarding budget execution, the following Figure shows the difference between total credits, meaning the initial resources for this policy, including modifications, for each budget period, the recognized obligations within the fiscal year itself, and the payments made to meet these obligations, both for the same period and for previous years. It should be noted that for the years 2009 to 2023, both the obligations and payments have been lower than the total credits, generating numerous uncovered credits, even for the years with the highest volume.

Figure 5: Evolution of Budget Execution for Housing Policy.



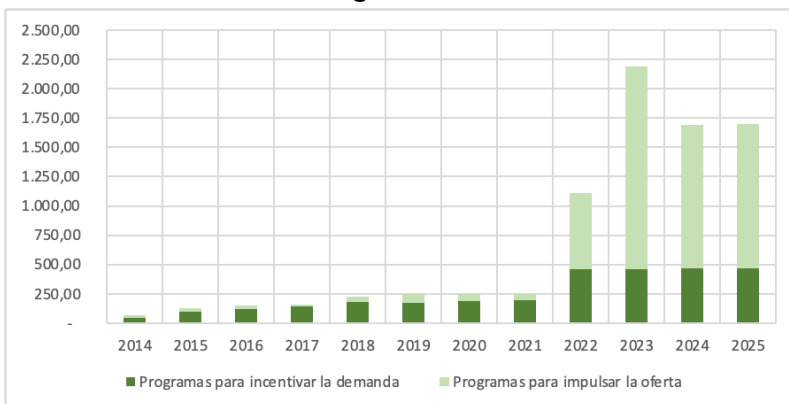
Source: General Intervention of the State Administration. National Accounting Office.

Regarding public resources specifically aimed at influencing the development of the residential rental market, these are integrated into the programs approved in the State Housing Plans (PEV) signed through agreements between the State and each of the Autonomous Communities (CC.AA.) of the common fiscal regime. According to the data provided in Figure 6, the relative weight of programs directed at rental housing represented 35% of the total PEV budgets in 2014. By 2018, this figure had already exceeded 50%, and for 2025, it is expected to surpass 95%, showing the high level of importance these programs have acquired for policymakers in the PEV.

Figure 6: PEV and Programs Directed at the Rental Market.

Source: *Agreements Signed Between Public Administrations.*

As shown in Figure 7, between 2014 and 2021, these programs focused on incentivizing demand, with their budget increasing by €200 million annually starting in 2022 due to the implementation of the Young Rent Voucher. From 2022 onwards, driven by the NGEU Funds, the programs aimed at boosting supply receive the highest budget allocations, intended for initiatives to increase the stock of rental housing.

Figure 7: Budgets for Specific Residential Rental Programs in the PEV.

Source: *Agreements Signed Between Public Administrations.*

The financing for residential rental programs aimed at stimulating demand with own funds, aside from the impact of the Young Rent Voucher and NGEU Funds, has far exceeded the funds allocated to programs aimed at boosting supply. For the period analyzed (2014-2025), a total of €2,202.60 million was allocated to demand subsidies compared to €881.39 million for supply programs.

In this context, the increase in rents for tenants through subsidies and grants inevitably leads to higher rents in the rental market, as noted by various authors (Andersson & Söderberg, 2012; Chapelle et al., 2019; Collinson & Ganong, 2018; Eriksen & Ross, 2015; Grislain & Trevien, 2022; Sayag & Zussman, 2020). This suggests that the use of these resources may have been counterproductive to the objectives set in all the PEVs, which aimed for affordable rental housing.

4. Recommendations

Based on the analysis of the implementation of the aforementioned instruments, several proposals can be made to improve their effectiveness in stimulating demand and boosting supply in the rental housing market.

Legislative changes are necessary to flexibilize the residential rental market by modifying certain laws, such as the Urban Leases Law to avoid limiting the duration of contracts, the Civil Procedure Law to prioritize eviction and precarious possession lawsuits to provide greater legal security to property owners, or the Right to Housing Law to eliminate rent controls and improve access to tax benefits.

Direct subsidies from programs aimed at stimulating demand should be eliminated, as increasing tenants' income pressures prices upward, as discussed earlier.

To stimulate supply, bureaucratic and administrative management in General Urban Planning Plans (PGOUs) could be facilitated, enabling a more agile land liberalization policy with all guarantees of compliance with current legislation, promoting the construction of social housing for rent and improving social housing classification for developers, including agreements with property owners.

Regarding taxation, reductions and bonuses for property owners could be increased, and to benefit vulnerable groups, these measures could be linked to tenants' income levels.

5. Conclusions

The following conclusions provide reflections and comments on the analysis in order to contribute to the debate on the measures adopted to stimulate the rental housing market in Spain.

Coordination between the Autonomous Communities (CC.AA.) and the State is essential, as it conditions the management and development of the instruments to be applied. Due to the distribution of competencies, the CC.AA. must implement the regulatory and programmatic instruments approved by the State Administration. However, bureaucratic and administrative burdens have not always been handled with perfect coordination regarding the application and appropriateness of programs and regulations, such as budgetary and management disorganization for certain subsidies or the approval of regulations that are not implemented, such as the lack of full implementation of Law 12/2023 across the entire common fiscal regime territory.

Related to the previous paragraph, the rental market lacks automatic mechanisms to increase the supply of residential rental housing. Existing instruments, such as regulatory and fiscal measures, have not helped improve the situation. For example, Law 12/2023 has had very limited territorial effects on rent control. Although it may be effective in the short term to curb the rise in average rental prices, it could reduce the supply of housing in “tensioned residential market areas” because property owners and developers may not be willing to accept the conditions imposed on new contracts under the law. Despite the fiscal benefits in this law, they do not seem to influence the decisions of the involved parties on their own.

Increasing the stock of social rental housing is a key objective that will be boosted by NGEU funds through financial instruments via public-private collaboration. However, the dynamics of public budgets with own funds in the last decade have not shown a favorable

trend. In fact, the approval of legislation to regulate the rental market has been a recurring mechanism due to the evident lack of public resources, and it is also necessary to ensure the legal security of both property owners and tenants.

The evident lack of public resources has not only been significant but has also been exacerbated by the failure to fully implement the State Budgets (PGE) regarding spending all the total credits approved for housing policy. As a result, annual opportunities to fully develop this policy have been lost, particularly in budget years with higher volumes of approved credits.

Programmatic and fiscal instruments aimed at improving tenants' income have provided new ways for property owners to increase rents up to the limits set by subsidy calls and the requirements established in contracts with tenants. The beneficiaries of these subsidies, such as the Young Rent Voucher, are driven to sign new contracts. This situation benefits the State fiscally, as property owners report higher incomes, and tenants report capital gains for tax purposes, as they are required to file income tax returns due to receiving subsidies. In a context of reduced fiscal benefits, this results in higher public revenues through taxation.

It is important to note that some of the instruments employed have been replicated and maintained over time, despite contributing to outcomes contrary to those desired by political authorities in the approved PEVs. This calls for a deep reconsideration of the programs and instruments used to ensure their utility.

This article has highlighted the most significant aspects of housing policy instruments in residential rental matters, showing a series of behaviors and initiatives that, far from fulfilling their objectives, may have negatively impacted the development of this market, which aims to ensure affordable access to housing. Instead, the market has evolved with rising rents and reduced supply.

6. Bibliography

- [1] Andersson, R., & Söderberg, B. (2012). Elimination of rent control in the swedish rental housing market: Why and how? *Journal of Housing Research*, 21, 159–181. 10.1080/10835547.2012.12092062

- [2] Aparicio, A., & Oppedisano, V. (2012). Fostering the emancipation of young people: Evidence from a spanish rental subsidy. (Nº. 6651). Institute for the Study of Labor (IZA). <https://docs.iza.org/dp6651.pdf>
- [3] Arruñada, B. (2022). Comentario a las nuevas regulaciones del alquiler. *Revista Del Instituto De Estudios Económicos*, (3), 129–145. <https://documentos.fedea.net/pubs/ap/2022/ap2022-12.pdf>
- [4] Autoridad Independiente de Responsabilidad Fiscal (AIReF). (2019). Evaluación de estrategia y procedimiento de subvenciones. Autoridad Independiente de Responsabilidad Fiscal (AIReF). <https://www.airef.es/es/estudios/estudio-evaluacion-estrategia-procedimiento-subvenciones/>
- [5] Autoridad Independiente de Responsabilidad Fiscal (AIReF). (2020). Beneficios fiscales. Autoridad Independiente de Responsabilidad Fiscal (AIReF). <https://www.airef.es/es/estudios/estudio-beneficios-fiscales/>
- [6] Autoridad Independiente de Responsabilidad Fiscal (AIReF). (2023). Instrumentos financieros del sector público para el apoyo a sectores productivos de la economía española. Autoridad Independiente de Responsabilidad Fiscal (AIReF). <https://www.airef.es/es/estudios/estudio-instrumentos-financieros-del-sector-publico-para-el-apoyo-a-sectores-productivos-de-la-economia-espanola/>
- [7] Banco de España (2024). Capítulo 4. el mercado de la vivienda en España: Evolución reciente, riesgos y problemas de accesibilidad. Informe anual 2023 (pp. 230–300). Banco de España.
- [8] Blanco Miguel, P., Borrego Alés, Y., & Chaves-Montero, A. (2024). Plan estatal para el acceso a la vivienda 2022-2025: Análisis de las estrategias contempladas para la reducción de la exclusión residencial. Paper presented at the IX Congreso De La Red Española De Política Social (2023), Palma de Mallorca. 145–151. <https://dialnet.unirioja.es/servlet/articulo?codigo=9648821>
- [9] Castaño Martínez, M. S. (2012). La eficacia de la política de la vivienda en España. *Información Comercial Española, ICE: Revista De Economía*, (867), 7–22. <https://revistasice.com/index.php/ICE/article/view/1521/1521>
- [10] Chapelle, G., Wasmer, E., & Bono, P. (2019). Spatial misallocation and rent controls. *AEA Papers and Proceedings*, 109, 389–92. 10.1257/pandp.20191024
- [11] Collado, N., Martínez, A., & Galindo, J. (2021). ¿Servirá la nueva ley de vivienda para mejorar el alquiler en España? (Nº. 32). <https://www.esade.edu/ecpol/es/publicaciones/servira-la-nueva-ley-de-vivienda-para-mejorar-el-alquiler-en-espana-2/>
- [12] Collinson, R., & Ganong, P. (2018). How do changes in housing voucher design affect rent and neighborhood quality? *American Economic Journal: Economic Policy*, 10(2), 62–89. 10.1257/pol.20150176
- [13] Eriksen, M. D., & Ross, A. (2015). Housing vouchers and the price of rental housing. *American Economic Journal: Economic Policy*, 7(3), 154–176. 10.1257/pol.20130064
- [14] Ferri Carreres, J., & Herranz Baez, F. (2023). Building on fiscal policy: Government consumption and the residential sector. when helping hurts. *Documentos De Trabajo (FEDEA)*, (1), 1–65. <https://fedea.net/building-on-fiscal-policy-government-consumption-and-the-residential-sector-when-helping-hurts/>
- [15] Fuente, A. d. l. (2023). Notas sobre el proyecto de ley de vivienda. *Fedea Economy Notes*, 2023(12), 8. <https://documentos.fedea.net/pubs/ap/2023/ap2023-12.pdf>

- [16] Gobierno de España. (2023). Plan de recuperación, transformación y resiliencia. componente 2. implementación de la agenda urbana española: Plan de rehabilitación y regeneración urbana. Ministerio de Hacienda y Función Pública. <https://planderecuperacion.gob.es/>
- [17] Gómez López, E. (2023). Desmontando las políticas públicas en el sector de la vivienda en la España del siglo XXI: Una perspectiva de las externalidades negativas que pueden llegar a tener las ayudas. *Revista Procesos De Mercado*, XX(1º 2023), 363–390. 10.52195/pm.v20i1.859
- [18] Grislain-Letrémy, C., & Trevien, C. (2022). The long-term impact of housing subsidies on the rental sector: The french example. (Nº. wp886).Banque de France. <https://publications.banque-france.fr/sites/default/files/medias/documents/wp886.pdf>
- [19] Harrington, N., Gibb, K., Smith, B., & Marsh, A. (2023). The impact of regulatory reform on the private rented sector. UK Collaborative Centre for Housing Evidence (CaCHE). <https://housingevidence.ac.uk/publications/the-impact-of-regulatory-reform-on-the-private-rented-sector/>
- [20] Kholodilin, K. A., & Kohl, S. (2023). Do rent controls and other tenancy regulations affect new construction? some answers from long-run historical evidence. *International Journal of Housing Policy*, 23(4), 671–691. 10.1080/19491247.2022.2164398
- [21] López García, M. A. (2019). Vivienda y política pública: Objetivos e instrumentos. Documentos De Trabajo (FEDEA), (7), 1–266. <https://documentos.fedea.net/pubs/dt/2019/dt2019-07.pdf>
- [22] Marsh, A., Gibb, K., & Soaita, A. M. (2022). Rent regulation: Unpacking the debates. *International Journal of Housing Policy*, 23(4), 734–757. 10.1080/19491247.2022.2089079
- [23] Ministerio de Asuntos Económicos y Transformación Digital. (2024). Programa de estabilidad 2021-2024. https://transparencia.gob.es/servicios-buscador/contenido/planesprogramas.htm?id=PLANESPROGRAMAS_1250&lang=es
- [24] Pareja Eastaway, M., & Sánchez Martínez, M. T. (2015). El sistema de vivienda en España y el papel de las políticas: ¿Qué falta por resolver? *Cuadernos Económicos De ICE*, (90), 149–174. 10.32796/cice.2015.90.6111
- [25] Pareja-Eastaway, M., & Sánchez-Martínez, T. (2022). Private rented market in Spain: Can regulation solve the problem? *International Journal of Housing Policy*, 23(4), 758–782. 10.1080/19491247.2022.2089080
- [26] Sayag, D., & Zussman, N. (2020). Who benefits from rental assistance? evidence from a natural experiment. *Regional Science and Urban Economics*, 80, 103395. 10.1016/j.regsciurbeco.2018.09.002
- [27] Taltavull de La Paz, P., Pérez Sánchez, R., Juárez Tárraga, F., Norman Mora, E., & Su, Z. (2023). Synchronisation among short-term rental markets, movements and cycles in 39 European cities. *Cities*, 134, 104148. 10.1016/j.cities.2022.104148
- [28] Valverde, S. C. (2024). Mercado inmobiliario y política de la vivienda en España (1ª ed.). Fundación de las Cajas de Ahorros (FUNCAS).
- [29] Van-Halen Rodríguez, J. (2016). La política de la vivienda en España: Una aproximación histórica <https://dialnet.unirioja.es/servlet/tesis?codigo=127404>

Digital Transformation Model for Universities: A Preliminary Proposal

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Abstract

This article presents a preliminary theoretical model of digital transformation for the Universidad Autónoma de Chile. The research corresponds to a case study with a mixed-methods approach (quantitative and qualitative), analyzing the dimensions and factors of the model based on input from 97 students and eight experts. The resulting model consists of three phases (availability of digital resources, use of digital resources, and integration of digital technologies), nine dimensions (strategy and culture, financial resources, technological infrastructure, student-centered focus, teaching-learning processes, economic and administrative processes, IT governance, capabilities and skills, and internal process management); it also identifies 54 indicators that highlight the relationship between digital maturity and value generation for students. The study identifies key success factors in the university's digital transformation, including student-centeredness, lifelong learning, commitment to the transformation process, and effective coordination and management of processes. The article concludes by outlining the factors that determine the institution's ability to implement strategic,

technical, and logistical technological changes. It also suggests further studies to redefine the roles of students, faculty, and administrative staff, increase digital maturity, continuously innovate services and processes, and create student-centered digital learning environments.

Keywords: digital transformation, digital maturity, educational technology, higher education, information technology.

1. Introduction

The main objective of this study is to construct a digital transformation model specific to the Universidad Autónoma de Chile, based on the essential dimensions and factors identified by students and subject matter experts. This article answers the question: What is the theoretical model of digital transformation that the Universidad Autónoma de Chile can implement?

To avoid possible misunderstandings, it is important to clarify that the digital transformation model describes a change process that uses technology as the foundation for its design and implementation. Therefore, in this article, the expressions “digital transformation model” and “digital transformation process” are used interchangeably for the purpose of disseminating the results of this research.

The value of information technologies in a knowledge economy has been analyzed from the perspective of profitability—from the moment a technological infrastructure is implemented in an organization to the point at which digital transformation is achieved through the alignment of strategy, structure, and technology to face the challenges of the digital environment. This evolution requires adopting a strategic approach focused on innovation—not only in products and services, but also in the interactions between users and technology. This affects finances, value creation processes, the use of technological resources, and the organizational structure.

In the field of higher education, there is still no clear data on the success rate of digital transformation projects (Catlin et al., 2015). This process has not kept pace with societal change and has often not been driven by a university-wide strategy, but rather by

discretionary decisions made by faculty, many of whom have lacked institutional support (Rodríguez-Abitia & Bribiesca-Correa, 2021). The challenges include generational differences between students and teachers, inadequate leadership, a resistant organizational culture, poor planning, and a lack of financial resources (Balyer & Öz, 2018; Rodríguez-Abitia & Bribiesca-Correa, 2021).

In this context, although the development of specific digital capacities leads to greater digital maturity and there are models for assessing effectiveness in companies (Castro et al., 2022), there is still no framework for measuring digital maturity in academia (Rossmann, 2019). This lack of research makes it difficult to implement digital transformation projects in higher education institutions, which need to address critical areas such as online teaching, the science and innovation system, knowledge digitalization, and university management. Even though digital transformation in the university context is not new, there is still no uniform understanding of its implications or how to manage it (Kopp et al., 2019).

Consequently, considering that the success of any disruptive change model in higher education depends on understanding each university's cultural and financial particularities, this research becomes especially relevant. The digital transformation model presented here is embedded in a framework that facilitates the development of key capabilities leading to success in the digital era.

2. Theoretical Framework

From a conceptual perspective, digital transformation has been defined from various approaches. For example, it has been understood as a change process—disruptive or incremental—that begins with the use of digital technologies and subsequently evolves toward the holistic digital transformation of the organization (Teichert, 2019), and as “a process that aims to improve an entity by causing significant changes in its properties through combinations of information, computing, communication, and connectivity technologies” (Vial, 2019, p. 119). It has also been defined as a process of organizational transformation (Brdesee, 2021) that facilitates the development of new models and competencies, strategically supported by digital technologies and

information about student success factors, resource allocation, and the effectiveness of educational and institutional programs (Marks et al., 2016).

Another perspective assumes that digital transformation is “the profound and accelerated transformation of activities, processes, competencies, and business models to fully leverage the changes and opportunities offered by digital technologies [...] in a strategic and prioritized manner” (Demirkan et al., 2016, p. 14), while other authors conceive digital transformation not as a process of transformation, but as a management process that guides the culture, strategy, methodologies, and capabilities of an organization based on the use of digital technologies (Crespo & Pariente, 2018).

The complexity of the elements involved in digital transformation has been emphasized by Rossman (2019), who points out the need to develop a set of capabilities linked to leadership, the market, operations, people and skills, culture, governance, and technology. Other authors relate digital transformation to four categories of factors: organizational values (culture), management capacity, organizational infrastructure, and workforce capabilities (Muehlburger et al., 2019).

According to Brdese (2021), digital transformation is based on five fundamental pillars: (1) a digital business strategy; (2) organizational engagement with customers and users; (3) the presence of an innovation culture; (4) technology; and (5) data analytics. This reveals that digital transformation goes beyond technological boundaries to become a strategic component of the value creation system. Regardless of the approach used, there is a certain degree of agreement in the literature that the digital transformation process transcends the purely technological and expands into the organization.

In the specific context of higher education institutions, digital transformation implies an accelerated renewal of processes, skills, and models to maximize the opportunities provided by digital technologies (Demirkan et al., 2016). It is also defined as a management process that guides the culture, strategy, methodologies, and capabilities of an organization through the use of digital technologies (Crespo & Pariente, 2018), and as a change—either disruptive or incremental—that begins with the use of digital technologies and evolves toward a holistic transformation of the organization (Teichert, 2019).

This new, globally interconnected scenario highlights the importance of ideas, innovation, and relationships (Kelly, 1997). Yet, although digital transformation has been a global priority for the past two decades (Xu et al., 2018), many organizations still struggle to change their routines, processes, structures, and culture—an issue that has broad implications for strategic management, governance, knowledge management, and innovation (Almatrodi & Skoumpopoulou, 2023).

This transformation requires profound cultural changes and new models of management, teaching, and innovation in organizational, technological, and sociocultural dimensions (Castro et al., 2022; Ramírez-Montoya, 2020). Therefore, knowledge management is an essential component for the digital transformation of universities and should not depend on temporary crises or the mere acquisition of technologies, as happened during the COVID-19 pandemic.

The dynamic and evolving nature of digital transformation implies understanding the concept of maturity as an integrated framework for measuring the development of key capabilities that lead to success in the digital era (Lorenzo, 2016). This maturation process requires progressive changes and incremental improvements to maximize the value of technology within organizations. Digital transformation demands an interdisciplinary and multidimensional model that defines how the organization interacts with its ecosystem to create value (Lorenzo, 2016). However, recent theoretical developments in digital transformation practices are generic and do not provide a specific framework for universities.

The construction of the model was based on the premise that it is possible to achieve a certain maturity of a university's strategic processes if the level of digitalization of each of the proposed dimensions in the construct reaches its highest level. The dimensions that form the preliminary structure of the digital transformation model for universities are shown in Table 1.

Table 1: Preliminary Structure of the Digital Transformation Model for Universities.

Theoretical Support	Dimension	Description
Catlin et al. (2015)	Key capabilities and resources	It involves digitizing the aspects that generate value within the organization and are sources of competitive advantage.
	IT investment	Adequate technical support, digitization of physical machines, virtualization, and the transfer of analog to digital.
Crespo y Pariente (2018)	Institutional strategic framework focused on digital transformation	A comprehensive strategy focused on the service provided by the university and driven by digital technology, which involves all processes that generate value in the long, medium, and short term.
Valdez de León (2016)	Student life cycle	New benefits created in the student experience thanks to digital transformation. This encompasses the student's journey through the university, promotion, recruitment campaigns, registration, teaching, job search, and alumni follow-up.
	Ecosystem	Focused on the stakeholder experience. It refers to the development of a strategic network of partners as a key element for a comprehensive solution for the student.
	Processes	Transforming teaching for digital education. Transforming the dynamics of teaching and learning.
Gobble (2018)	Organization and structure	How functions are organized within the University, roles and responsibilities, talent and learning, governance, IT leadership, and how work is designed and adapted through ICT.
Furedi (2011)	Points of contact with the student	Students need support anytime, anywhere, and on any device. Service points must be digitalized.
Salinas y Vio (2011)	Flexible and personalized teaching	From one-size-fits-all to tailored learning. Managing individualized student information through predictive data analytics to deliver personalized advising systems.

Theoretical Support	Dimension	Description
Sánchez y Fernández (2010)	Social Networks and Profile Research.	It involves educational marketing, recruiting new students, analyzing click-through rates to assess the performance of online content, understanding perceptions of my university's academic programs, identifying areas for service improvement, and creating new programs that address these needs.
Westerman et al. (2012)	Digital culture	Dimension resulting from combining digital intensity (or level of investment in technological initiatives) and digital transformation management intensity, understood as the level of investment in leadership capabilities to implement technology-based changes.

3. Materials and Methods

Due to the nature of the data required to develop the model, a field design with a mixed-methods approach (quantitative and qualitative), cross-sectional, and exploratory level was used (Malhotra, 2004). For the sample selection, non-probabilistic techniques based on the approaches of Denzin and Lincoln (2000) were applied, resulting in the sample composition shown in Table 2.

Table 2: Composition of the Sample Used for the Research.

Sample Description	Sample Size	Gender Distribution	Distribution by Field of Study	Technique (Instrument)
Students	97	55 Men (56,7%) 42 Women (43,3%)	Administration and Economy (73,2%) Engineering (24,7%) Other areas of study (2,1%)	Survey (questionnaire)
Experts	8	6 men (75%) 2 women (25%)	-	In-depth interviews

To collect student data, a preliminary model was created, consisting of 11 dimensions and 55 underlying factors. This model was developed based on theoretical contributions derived from the main dimensions that constitute the structural basis for constructing the university digital transformation model (Table 3).

Table 3: Factors implicit in each of the dimensions considered for developing the digital transformation model.

Dimensions	Factors
Institutional Strategic Framework focused on digital transformation.	• Mission and Vision, focused on digital. • Strategic objectives with an IT focus. • Positioning through digital platforms. • Student loyalty strategies with a digital focus. • Digital initiatives aligned with corporate strategy
Digital culture.	• Training focused on digital technologies. • Promotion of projects on digital topics. • Tolerance for change. • Capacity for continuous learning. • Comprehensive approach to the student experience.
Organization and structure	• Digital technologies present in organizational processes. • Digitization of administrative processes. • Digital technologies in workflows. • Digitally adaptable organizational structure. • Decision-making incorporating IT.
Critical capabilities and key resources	• Data-driven decision-making. • IT focus on student loyalty and the university brand. • IT-focused problem-solving for students. • Technologies for optimizing the organization's back office. • Services accessible anywhere, anytime.
Student Lifecycle Value	• Digitization of the student lifecycle. • Incorporation of IT for student satisfaction and retention. • Academic and pedagogical support with an IT focus. • Internships and job searches with a digital focus. • Incorporation of IT for continued studies.

Dimensions	Factors
Ecosystem (strategic partners and allies that a university should have)	• Relations with companies and corporations. • Relations with communities and social groups. • Relations with foundations/NGOs. • Relations with international universities. • Links with students and faculty at other universities.
Flexible and personalized teaching	• Incorporation of IT into students' learning patterns. • Teaching model tailored to the student's physical location. • Use of predictive data to anticipate student needs. • Individualized counseling system. • Adaptation of teaching to each student's profile.
Points of contact with the student	• Digital library. • Digital platform for student affairs. • IT support to foster work groups. • Digital cafeteria services. • Digital support for student-director-secretary relationships.
Social networks and profile research	• Analysis of positioning indicators. • Analysis of student perceptions on social media. • Identification of areas for improvement in digital services. • Recruitment of potential students through social media. • Promotion of collaborative learning on social media.
Processes of transformation of teaching for higher education	• Application of ICT in the teaching-learning process. • Training in digital pedagogical strategies. • Student life integration project - teaching strategy. • Incorporation of digital teaching strategies for family integration. • Integration of student socioeconomic status with digital teaching strategies.
Investment in IT	• Investment in learning platforms. • Quality technical support for digital processes. • Automation of teaching services for students. • Investment in administrative technology platforms. • Improvement of contact points with students through ICT.

The preliminary digital transformation model was evaluated for its relevance and practical applicability through a questionnaire that had previously been validated using the expert judgment technique, involving 40 evaluators, resulting in an overall content validity index of 0.714.

Once validated, the questionnaire was distributed via Google Forms to the 97 students who participated in the study, allowing them to indicate, using a five-point Likert scale, the degree of importance they attributed to each dimension of the digital transformation model, as well as to each intrinsic factor within those dimensions.

Additionally, eight semi-structured interviews were conducted with senior officials from the Universidad Autónoma de Chile and experts in digital transformation, who contributed their knowledge, reflections, and assessments regarding the subject of study. These interviews were recorded, transcribed, and coded by assigning conceptual categories to information segments relevant to achieving the study's objectives.

The analysis was carried out in three phases: first, a microanalysis of each interview was conducted, initiating an open coding process using Atlas.ti software. This phase provided a comprehensive understanding of the data and concluded with a broad description of each analyzed category.

In the second phase, the data obtained were grouped and classified using descriptive codes that aligned with each interview question. Through axial coding, these descriptive units were clustered into categories, and new memos were created to describe the properties of each.

Finally, in the third phase, a matrix of intensity was developed to identify meaningful relationships and patterns that informed the theoretical model of the university's digital transformation process. This model consolidates and integrates the information provided by both the students who completed the questionnaire and the interviewed experts.

4. Results

4.1. Quantitative Results

The quantitative analysis revealed an even distribution of importance across the dimensions related to digital transformation within a university. The three main factors identified in this process were all within the “Digital Culture” dimension, listed by importance as follows: continuous learning capacity (1.96%), tolerance to change (1.95%), and a holistic focus on the student experience (1.94%).

Conversely, the three least relevant factors, according to respondents, belonged to the “Social Networks and Profile Research” dimension, in descending order: analysis of student perceptions on social media (1.77%), promotion of collaborative learning through social media (1.77%), and recruitment of potential students via social media (1.76%).

4.2. Qualitative Results

The main findings from the interviews with the eight consulted experts first reflect a strong tendency to highlight the student-centered approach as fundamental in digital transformation. It was repeatedly emphasized that the key areas of digitalization are those that enable students to receive complete, accurate, timely, and relevant information about academic and administrative processes, including the digitalization of libraries and the effective use of learning platforms.

The importance of this aspect is underscored by the assertion that a university’s digital maturity is closely linked to student satisfaction. However, it is acknowledged that this maturity is always relative, as it depends on user perception. Thus, digital maturity includes a subjective component that goes beyond processes, finances, and technological capacity. It was also noted that focusing on the student experience—reflecting institutional culture, strategic vision, and transition management capacity—is vital in digital transformation processes.

Another key factor in determining a university's digital maturity is IT governance, which enables the generation and implementation of digital initiatives. Additionally, indicators such as the correlation between academic performance and job placement, and the ability for students to complete academic activities from home, are also mentioned.

Interviewees identified the main drivers of digital transformation in universities as:

Corporate goals (vision, mission, strategic objectives), embedded in organizational culture and strategy, including the desire to remain at the forefront of knowledge and technology.

The commitment of all educational community members to change processes.

The learning curve acquired through the gradual development of the transformation process.

Effective communication to manage the technological foundation and decision-making.

It was argued that digital transformation requires transforming talent so that individuals clearly understand the strategic direction regarding what to retain and what to change.

From another perspective, digital maturity is seen as comprising three stages:

- Availability of digital resources
- Use of those resources
- Integration of technological platforms

Thus, indicators of digital maturity should be associated with factors that measure progress in transformation based on targeted objectives.

While interviewees agreed that Chilean universities are generally ready to begin digital transformation, they also acknowledged cultural and financial barriers, particularly the need for investment in technology. These aspects can significantly influence a university's digital maturity, along with the type of technology used, the skills

to manage it, decision-making capabilities, leadership, and change management competencies.

Cultural factors, such as generational dynamics, were also emphasized. There is a need to integrate younger faculty members with a global digital perspective and high learning capacity.

Another concern was the challenge of combining hard technical skills with soft skills, especially in the initial stages, justifying the need for constant monitoring to anticipate potential risks of failure.

Regardless of the type of institution (public or private), there was broad consensus that digital transformation must be led by the highest levels of governance (rectorate and vice-rectorates), and managed by a planning, innovation, and development office capable of mobilizing various functional areas and structuring a dedicated transformation team. Digital transformation should be seen as an institutional policy initiated by university leadership to promote innovation and integrate digital technologies throughout the institution.

Despite the human and organizational gaps in managing change, experts warned against abrupt digitalization efforts, recommending pilot projects to achieve small wins that pave the way for larger changes. Lifelong learning and leadership—particularly from IT and academic units—were identified as key enablers of the transformation process.

From these insights, three essential components of digital transformation processes can be highlighted:

- The cultural aspects that define a university's strategic decisions regarding digital infrastructure and financial resources.
- A student-centered approach for designing and managing new academic and administrative processes.
- The technical skills and leadership capacities required to manage internal processes for effective digital transformation.

4.3. Theoretical Model of Digital Transformation

Based on the findings, the digital transformation process in a university is structured into three phases:

- Availability of Digital Resources:

This includes the adoption and implementation of institutional policies and strategies related to acquiring, using, and integrating digital technologies.

- Use of Digital Resources:

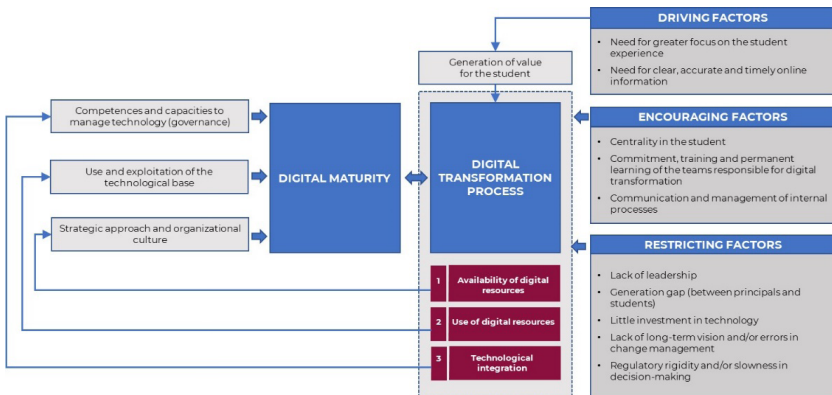
Refers to how technological infrastructure is used for academic and administrative processes. It requires recognizing the potential of new technologies and implementing initiatives to enhance student experiences, streamline internal processes, and improve competitiveness.

- Integration of Digital Technologies:

This phase focuses on connecting technology with the broader environment, developing capacities, and implementing initiatives aimed at institutional improvement by reconfiguring traditional structures, always maintaining focus on the student experience.

In this theoretical model (Figure 1), the foundation of the process is to generate greater value for the student, as the consulted experts agreed that no digitalization effort makes sense if it does not prioritize the student experience and the provision of clear, accurate, and timely information.

Figure 1: Theoretical Model of the Digital Transformation Process in a University.



5. Discussion and Conclusions

Based on the results obtained, it is emphasized that the digital transformation model of the Universidad Autónoma de Chile reflects the close relationship between digital maturity and the creation of value for the student through teaching-learning processes and economic-administrative processes. This relationship is linked to three main factors: (1) the strategic approach and organizational culture; (2) the use and exploitation of the available technological base; and (3) the competencies and skills demonstrated to handle technology.

These three elements, determinants of the success of the university's digital transformation process, require the student to be considered the focal point in decision-making, but also require commitment, training, and continuous learning from the people responsible for managing technological change. This, in turn, demands clear leadership, as well as adequate communication and coordination between the academic-administrative areas responsible for managing the processes carried out in the institution.

This seems to be condensed in what Pelletier and Hutt (2021) define when they state that digital transformation is: “a series of profound and coordinated changes in culture, workforce, and technology that enable new educational and operational models and transform the business model, strategic directions, and value proposition of an institution” (p. 30), implying the need for innovative leadership at all levels of the institution, as well as coordination among the different units.

In this regard, any effort to change towards the digitalization of university systems and processes requires a prior recognition of the university model that is aspired to; of course, within a digital logic and in harmony with the social mission of the university. This will not only boost the mechanisms that guarantee higher educational quality but also ensure a transformation process that takes into account the digital competencies (current and desired) of students, teachers, and those responsible for gradually incorporating technologies into academic-administrative processes, facing the challenges posed by digitalization, and consolidating regional, national, and supranational alliances that will support the initiation of other disruptive processes that

consciously allow anticipation of new scenarios arising from scientific and technological advances in the global context.

Thus, the financial difficulties a university may face, its cultural tradition, regulatory rigidity, lack of a clear vision of what is intended to be achieved through the digital transformation process, and the errors that may occur both in change management and in the implementation of new technologies are factors that could not only reduce the institutional capacity to implement technological changes but could also have contradictory effects on the economic and social dimensions of the university's sustainability strategy.

On the other hand, the model design verifies what Xiao (2019) has highlighted when arguing that digitalization, as perceived by universities in China and other countries, seems to be oriented towards the instrumental creation of digital campuses and the development of innovations in academic processes, but lacks sufficient incentives for digital technologies to improve research capacity and serve a wider community. In fact, during the data collection process, none of the experts consulted mentioned the improvement of scientific activity, understood as one of the substantive activities of universities. This aspect was not reflected in any of the models used as the basis for building the Universidad Autónoma de Chile's digital transformation theoretical model, which warrants further studies to determine why, in the case of higher education, this transformation process appears to be confined to the internal context of institutions.

In this sense, within IT governance, as the dimension of the process of transformation that contributes most to the digital maturity of a university (21.96%), it is necessary to clarify how the institution's digital structure allows alignment of strategic, technical, and logistical needs with the redefinition of the roles of administrative staff, faculty, and students, in order to promote the continuous innovation of services and processes, and create new digital learning spaces centered on the student.

This would lead to future studies attempting to clarify potential issues and needs arising from the new technological interactions that will take place within the university, as well as the identification of new opportunities offered by these connections in the context of university social responsibility.

Based on the findings presented in this study, the following conclusions are drawn:

- The digital maturity of the Universidad Autónoma de Chile will be mainly determined by how the available technological resources are utilized and the ability to integrate different technologies.
- The way information technology is managed (IT governance) is the dimension that most contributes to achieving the university's digital maturity.
- The digital maturity of the university is a variable closely interconnected with the digital transformation process, which is influenced by: (1) the skills and abilities to manage technology; (2) the use and exploitation of the technological base; and (3) the organizational culture and strategic approach of the institution.
- The factors that facilitate the digital transformation process in the university are: (1) the student-centered approach; (2) continuous learning and commitment demonstrated by the entities responsible for carrying out the process; and (3) effective coordination and management of processes carried out in the involved areas.
- The main factors that could hinder the implementation of the digital transformation process in the university are: (1) lack of leadership and short-term vision; (2) slow decision-making processes; (3) generational gap between teachers and students; and (4) insufficient investment in the technological base.

Having reached these conclusions and considering the exploratory nature of this research, it is recommended to conduct new studies to verify the consistency, reliability, and validity of the university's digital transformation model, suggesting the use of structural equation modeling. In any case, even if the model presented in this article is validated, it is recommended to determine its impact on students before implementation. For this purpose, the Student Satisfaction Index model proposed by Turkyilmaz et al. (2018) can be used.

Additionally, considering the findings reported, new questions arise that deserve to be answered from a scientific perspective. For example, one area of possible research would be to analyze the influence of organizational routines on the adoption of an organizational culture

aligned with the demands of the digital ecosystem in the context of higher education, and assess the potential impact of digital transformation on the university's sustainability.

From a non-scientific perspective, it is suggested that those responsible for managing the implementation of the digital transformation model in the university consider the influence of power relations during the transition process towards digital transformation, as this will affect the coordination of internal processes associated with information management, the actions of people with technical and management responsibilities, faculty performance, and student confidence in future academic and administrative processes.

6. Bibliography

- [1] Almatrodi, I., & Skoumpopoulou, D. (2023). Organizational Routines and Digital Transformation: An Analysis of How Organizational Routines Impact Digital Transformation Transition in a Saudi University. *Systems*, 11(5), 239. <https://doi.org/10.3390/systems11050239>
- [2] Balyer, A., & Öz, Ö. (2018). Academicians' Views on Digital Transformation in Education. *International Online Journal of Education and Teaching*, 5(4), 809-830. <https://eric.ed.gov/?id=EJ1250526>
- [3] Brdesee, H. (2021). A Divergent View of the Impact of Digital Transformation on Academic Organizational and Spending Efficiency: A Review and Analytical Study on a University E-Service. *Sustainability*, 13(13), Article 13. <https://doi.org/10.3390/su13137048>
- [4] Castro, L. M., Tamayo, J. A., Burgos, D., & Martens, A. (2022). Measuring digital transformation in higher education institutions – content validity instrument. *Applied Computing and Informatics*, ahead-of-print(ahead-of-print). <https://doi.org/10.1108/ACI-03-2022-0069>
- [5] Catlin, T., Scanlab, J., & Willmott, P. (2015). Raising your Digital Quotient | McKinsey. McKinsey Quarterly, 1-13. <https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/raising-your-digital-quotient#/>
- [6] Crespo, B., & Pariente, E. (2018). Barómetro sobre la madurez digital en España 2018. <https://circulodeempresarios.org/transformacion-digital/wp-content/uploads/PublicacionesInteres/11.barometro-madurez-digital-espana-2018.pdf>
- [7] Demirkan, H., Spohrer, J. C., & Welser, J. J. (2016). Digital Innovation and Strategic Transformation. *IT Professional*, 18(6), 14-18. <https://doi.org/10.1109/MITP.2016.115>
- [8] Denzin, N. K., & Lincoln, Y. S. (2000). The Discipline and Practice of Qualitative Research. En N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (2nd ed., pp. 1-34). Sage Publications.

- [9] Furedi, F. (2011). The Objectification of Fear and the Grammar of Morality. En H. Sean (Ed.), *Moral Panic and the Politics of Anxiety* (pp. 90-103). Routledge. <https://doi.org/10.4324/9780203869727>
- [10] Gobble, M. M. (2018). Digitalization, Digitization, and Innovation. *Research-Technology Management*, 61(4), 56-59. <https://doi.org/10.1080/08956308.2018.1471280>
- [11] Kelly, K. (1997). *New Rules for the New Economy*. Penguin Books.
- [12] Kopp, M., Gröbinger, O., & Adams, S. (2019). Five common assumptions that prevent digital transformation at higher education institutions. *INTED2019 Proceedings*, 1448-1457. <https://doi.org/10.21125/inted.2019.0445>
- [13] Lorenzo, O. (2016). Modelos de Madurez Digital: ¿en qué consisten y qué podemos aprender de ellos? *Boletín de Estudios Económicos*, 71(219), 573-590. <https://dialnet.unirioja.es/servlet/articulo?codigo=5808328>
- [14] Malhotra, N. (2004). *Investigación de Mercados* (4.a ed.). Pearson Educación.
- [15] Marks, A., AL-Ali, M., & Rietsema, K. (2016). Learning Management Systems: A Shift Toward Learning and Academic Analytics. *International Journal of Emerging Technologies in Learning (iJET)*, 11(04), Article 04. <https://doi.org/10.3991/ijet.v11i04.5419>
- [16] Muehlburger, M., Rückel, D., & Koch, S. (2019). A Framework of Factors Enabling Digital Transformation. *Americas Conference on Information Systems*, Cancun. <https://www.semanticscholar.org/paper/A-Framework-of-Factors-Enabling-Digital-Muehlburger-R%C3%BCckel/93be7eff8a9ac2da441899164f8803a1c64c47a9>
- [17] Pelletier, K., & Hutt, C. (2021). Digital Transformation: Equipping Advisors for the Journey, Students for Success. *Change: The Magazine of Higher Learning*, 53(3), 30-36. <https://doi.org/10.1080/00091383.2021.1906142>
- [18] Ramírez-Montoya, M. S. (2020). Transformación digital e innovación educativa en Latinoamérica en el marco del CoVId-19. *Campus Virtuales*, 9(2), 123-139. <https://dialnet.unirioja.es/servlet/articulo?codigo=8005986>
- [19] Rodríguez-Abitia, G., & Bribiesca-Correa, G. (2021). Assessing Digital Transformation in Universities. *Future Internet*, 13(2), 52. <https://doi.org/10.3390/fi13020052>
- [20] Rossmann, A. (2019). Digital Maturity: Conceptualization and Measurement Model. Bridging the Internet of People, Data, and Things. 2, 13-16. https://www.researchgate.net/publication/345760193_Digital_Maturity_Conceptualization_and_Measurement_Model
- [21] Salinas, J., & Vio, F. (2011). Programas de salud y nutrición sin política de Estado: El caso de la promoción de salud escolar en Chile. *Revista chilena de nutrición*, 38(2), 100-116. <https://doi.org/10.4067/S0717-75182011000200001>
- [22] Sánchez, A., & Fernández, M. P. (2010). Informe Generación 2.0 2010: Hábitos de los adolescentes en el uso de las redes sociales. Estudio comparativo entre Comunidades Autónomas (p. 41). Universidad Camilo José Cela. https://www.observatoriodelainfancia.es/ficherosoia/documentos/2824_d_generacin2-0-100706100017-phpapp01.pdf
- [23] Teichert, R. (2019). Digital Transformation Maturity: A Systematic Review of Literature. *Acta Universitatis Agriculturae et Silviculturae Mendelianae*

- Brunensis, 67(6), 1673-1687. https://ideas.repec.org//a/mup/actaun/actaun_2019067061673.html
- [24] Turkyilmaz, A., Temizer, L., & Oztekin, A. (2018). A causal analytic approach to student satisfaction index modeling. *Annals of Operations Research*, 263(1), 565-585. <https://doi.org/10.1007/s10479-016-2245-x>
- [25] Valdez-de-Leon, O. (2016). A Digital Maturity Model for Telecommunications Service Providers. *Technology Innovation Management Review*, 6(8). <https://doi.org/10.22215/timreview/1008>
- [26] Vial, G. (2019). Understanding digital transformation: A review and a research agenda—ScienceDirect. *The Journal of Strategic Information Systems*, 28(2), 118-144. <https://doi.org/10.1016/j.jsis.2019.01.003>
- [27] Westerman, G., Bonnet, D., & McAfee, A. (2012, noviembre 20). The Advantages of Digital Maturity. *MIT Sloan Management Review*. <https://sloanreview.mit.edu/article/the-advantages-of-digital-maturity/>
- [28] Xiao, J. (2019). Digital transformation in higher education: Critiquing the five-year development plans (2016-2020) of 75 Chinese universities. *Distance Education*, 40(4), 515-533. <https://doi.org/10.1080/01587919.2019.1680272>
- [29] Xu, M., David, J. M., & Kim, S. H. (2018). The Fourth Industrial Revolution: Opportunities and Challenges. *International Journal of Financial Research*, 9(2), 90-95. <https://doi.org/10.5430/ijfr.v9n2p90>

The relationship between the impact of archaeological tourists and sparsely populated rural areas

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Abstract

Archaeological sites open to visitors, located in rural areas, receive tourists and visitors in a regulated manner, thereby establishing a socio-economic impact relationship between the tourist resource they visit and its sparsely populated rural surroundings. Using a semi-structured survey with random sampling, data were collected from 564 visitors at four heritage sites in the province of Cuenca (Spain): Segóbriga, Valeria, Noheda, and Ercávica. These sites, of significant archaeological and touristic value, are situated in low-density population areas, where cultural tourism can become a driver of development and a deterrent to depopulation. The aim is to show how visitor decisions directly impact not only the archaeological site but also the surrounding rural environment through the use of hospitality services (such as restaurants and accommodations). The research reveals a direct relationship between tourists' decisions (overnight stays, dining, type of visit) and a positive impact on the local economy. Moreover, it is a replicable methodological reference for other regions with similar characteristics in Spain and internationally. This study differs from previous research through its focus on rural destinations, its analysis of real visitor behaviour, and the use of a flexible methodology adapted to the specific context. The investigation contributes to the body

of knowledge in archaeotourism, heritage management, and sustainable rural development, opening new lines for future research.

Keywords: Tourist profile, archaeological tourism, rural development, socio-economic impact, depopulation.

1. Introduction

This study aims to analyze the impact that the cultural tourist profile has on the environment when visiting tourist resources, such as archaeological sites located in rural areas with low population density. To address this issue, the study includes an extensive segmentation of visitor types, assessing their sociodemographic and economic characteristics, as well as specific factors that influence their decision-making processes.

The goal is to understand the profile of tourists, specifically cultural tourists, who visit archaeological sites and impact the surrounding rural and sparsely populated areas. This will enable managing organizations to design more efficient promotional and dissemination campaigns, thereby achieving greater socioeconomic impact in these regions. To this end, a semi-structured survey with random sampling was employed, proving to be an effective methodological tool for distinguishing the decisions made by cultural tourists compared to other types of visitors.

The semi-structured survey with random sampling is particularly effective for analyzing tourist behaviour, especially in rural environments where dynamics are complex and heterogeneous. This technique allows for the structured yet flexible collection of both quantitative and qualitative information, facilitating adaptation to the characteristics of the environment and visitor profiles. As noted by Hernández Sampieri, Fernández-Collado, and Baptista [9], semi-structured surveys allow for deeper exploration of the subjective aspects of the tourist experience while providing systematized data for comparative analysis.

In this study, the application of this methodological approach has enabled the integration of multiple variables—sociodemographic

characteristics (gender, age, origin), tourism preferences, and economic factors (type of accommodation, use of hospitality services)—into a coherent analytical framework. Through a clear segmentation of categories and a representative random sample, the technique has helped clarify how these dimensions influence the choice of archaeological destination and the activities carried out during the visit.

Moreover, this methodology enables a detailed observation of cultural tourists' decision-making in key aspects such as length of stay, personal motivations, perception of site management, and willingness to explore nearby attractions. In this regard, authors like Veal [25] emphasize the suitability of structured and semi-structured surveys in tourism contexts to generate empirical evidence useful for strategic planning and decision-making in heritage destinations.

Therefore, this technique not only provides methodological rigour to the analysis of visitor profiles but also proves to be a versatile and easily replicable tool for related research. It is especially useful in contexts where cultural tourism can serve as a driver of rural development, as it allows for a comprehensive quantification of its socioeconomic impact by linking the behaviour patterns of each visitor type to their environment. Additionally, it facilitates the identification of management opportunities that enhance synergies between cultural tourism and complementary services available in rural areas with low population density.

2. Theoretical Framework

Cultural and Heritage Tourists have been categorized in various ways [23]. In this regard, identifying and understanding the typologies of heritage tourists—their motivations, behaviours, perceptions, and experiences—is crucial for effectively addressing visitor management plans and marketing strategies [18]. McKercher's [16] classification of cultural tourists was the first to employ both stages of travel: before and during the visit.

Analyzing the tourist experience and the critical factors that influence tourist satisfaction is imperative [15]. More specifically, motivations

stimulate tourists' choice when deciding to visit a particular cultural destination or a specific archaeological site [8]. Thus, the relationship between motivations, expected and perceived value of the destination, and the monument itself is interconnected [10].

The ability to determine tourists' intentions to visit or revisit archaeological sites at different times has been explained by some authors through their religious, social, and historical connection to the site [4]. However, others suggest that cultural openness, understanding, awareness, and participation are identified as elements of tourists' cultural competence, which can facilitate positive cultural behaviour [14].

Undoubtedly, heritage tourism has played a fundamental role in the revival of cultural and historical values, the dissemination of archaeological knowledge, environmental improvement, and the progress of local communities [5]. Archaeological and cultural resources have significantly contributed to tourists' experiences. Moreover, more versatile methods and creative approaches are now being integrated to develop interpretative and effective methods for both educational and entertainment purposes [1]. However, greater attention should be paid to how to integrate various local community resources into heritage tourism [13].

Li and Qian [13] studied tourists' perceptions at Daming Palace in China, using structured questionnaires to assess the visitor experience in an archaeological setting. This methodology has been adopted in the present study, although the most notable difference lies in the territorial context in which it is applied. While their research focuses on a large city with high tourist flows, the current study analyzes rural Spanish sites facing depopulation issues.

The idea of developing a successful and innovative strategy for the sustainable growth of cultural tourism—one that involves the municipality and its surroundings—is based on analyzing visitors' motivations and activities related to archaeological tourism. The aim is to revalue local cultural and natural resources by creating innovative tourist experiences [19]. These authors examined the creation of innovative tourist experiences through the valorisation of archaeological sites in Southeast Europe, emphasizing the importance of linking heritage with tourism sustainability, much like the present study. However, a key difference is that their approach focuses more on

value-enhancement proposals from the supply side, whereas this work focuses on analyzing the tourist profile and their actual behaviour through a semi-structured survey with random sampling.

Nevertheless, the specific situation of a cultural tourist visiting an archaeological site opens the door to new questions related to their behaviour. This becomes particularly relevant at historical sites where overtourism not only disrupts the environment but also causes damage, despite the economic benefits it brings. Issues such as litter accumulation, wear and tear of structures, and disorganized visitor movement affect both site management and the visitor's perception of the experience [17].

In the specific field of archaeotourism, when archaeological sites are managed as tourist attractions, it is important to analyze how visitors use them [3]. It is particularly interesting that, to achieve sustainability in heritage tourism, it is argued that tourists must be placed at the centre of management and planning processes, as their levels of acceptance drop significantly with an unbalanced and excessive influx of tourists [2].

Cultural visitors tend to be more preservation- and conservation-oriented and support and reward effective management actions when achieved. Nevertheless, most tourists have been overlooked in the management of heritage attractions [2].

The impact of cultural heritage management on the tourism development of an area [7] speaks to the quality of performance, which is under the control of management [6]. This fact shows that archaeology has not been the central axis of tourism strategies in government agendas.

3. Materials and Methods

3.1. Data Collection Through the Sample

To define the profile of the tourist that influences the environment, a structured questionnaire was designed, and a representative sample was calculated based on the total number of annual visitors recorded

in 2022 at the four selected archaeological sites. In total, the sites of Segóbriga, Valeria, Noheda, and Ercávica received 77,677 visitors.

To determine the minimum number of surveys needed to obtain a representative sample of the visitor population at the archaeological sites in 2022, a 95% confidence level and a 5% margin of error were applied. With these parameters, it was calculated that at least 383 people needed to be surveyed. Ultimately, the survey reached a total of 564 respondents, exceeding the established minimum of 383. To carry out the data collection, the questionnaire was made visibly available via a QR code format at the four tourist sites. The study is based on the premise of identifying the cultural tourist profile through spontaneous participation in the survey. This premise is important to avoid indirectly influencing the responses.

3.2. Description of the Sample Data

The questionnaire aims to evaluate the impact of cultural and archaeological tourism on the surrounding environment. For this purpose, distinct categories were taken into account and organized in a flowchart format in Table 1, including: socio-demographic aspects (age, gender, and origin); economic aspects (type of accommodation chosen, overnight stays, food services, type of visit, and trip duration); and characteristics specific to the visitor profile, which encompass travel behavior (motivations such as types of tourism, interest, prior knowledge and experience; frequency; perception; and satisfaction). These elements are part of tourism studies on the cultural tourist profile [11, 20-22, 24]. These studies show that different audience segments exhibit different behaviours at a destination, even if their demographic patterns and travel profiles are similar.

3.3. Variables in the Statistical Model

To develop the study, both direct and indirect influencing variables were considered within the statistical model. For this, a quantitative analysis was conducted through a semi-structured survey using random sampling. First, the different variables were coded for subsequent analysis. The dependent variable of the study is the “environment,”

which is the core of the research. The coding is defined as 1 = “has an impact on the environment” and 0 = “does not have an impact on the environment.” This variable includes the decisions made by cultural tourists who choose to stay overnight at the archaeological sites and/or eat at nearby restaurants or bars during their visit to the tourist resource, whether as a round trip or as part of a longer journey.

In this sense, the dependent variable implies a primary value in which the socioeconomic impact is key. The independent variables should determine the extent to which visitors’ decisions influence this impact [12]. Thanks to their interconnection within decision trees, specific profiles can be formulated to define the type of visitor engaging in archaeological tourism. For this reason, the independent variable most directly linked to the dependent variable is archaeological tourism. From there, each variable was first analyzed within its context, and once this analysis was completed, connections to the statistical model were established.

The data analysis was carried out independently by classifying the variables into distinct categories: socio-demographic, economic, and characteristics specific to the visitor profile.

4. Results

4.1. Results from the questionnaire

By listing each of the responses obtained in the questionnaire and analyzing them, it is evident that the data itself provides clear and conclusive information (see Table 1). The study’s dependent variable, which seeks to determine whether archaeological tourism can have a socioeconomic impact, shows that 84.9% spend the night and/or eat in the surrounding area, while 15.1% do not.

Table 1: Percentages of the variables in the sample.

CHARACTERISTICS	VARIABLE	CONCEPT	%
Impact	Environment	Impact on the environment	84.9
		No impact on the environment	15.1
Sociodemographic	Gender	Female	55.3
		Male	44.7
	Age ranges	Up to 31 years old	20.2
		From 32 to 44 years old	20.6
		From 45 to 54 years old	19.2
		From 55 to 62 years old	20.2
		Over 62 years old	19.7
	Place of origin	Local area (Cuenca/Guadalajara)	27.3
		Castilla-La Mancha	5.5
		Rest of Spain	66.3
		Abroad	0.9

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Economic	Type of accommodation	Tourist apartment	5.0
		Campsite	0.9
		Rural house	5.9
		Hostel	2.1
		Hotel	17.2
		Other	1.8
		Guesthouse	0.4
		Relative's/friend's home	13.1
		Usual residence	45.4
		Second residence	8.3
	Overnight stays	Overnight stay in tourist accommodation	33.2
		No overnight stay	66.8
	Within overnight stays	Overnight stays in the area	75.3
		No overnight stay in the area	24.7
	Food services	Stay to eat in the area	76.8
		Do not stay to eat in the area	23.2
	Type of visit	Friends	32.3
		Family	31.6
		Organized group	5.7
		Couple	27.8
		Alone	2.7
	Trip duration	Excursion without route through the area	18.9
		Excursion with route through the area	55.7
		Trip without route through the area	3.2
		Trip with route through the area	22.2
Tourist Profile: Motivations			

Sustainability, Innovation and Social Impact

Tourist Profile: Motivations	Archaeological tourism	Preference for archaeological tourism	62.6
		No preference for archaeological tourism	37.4
	Cultural tourism	Preference for cultural tourism	62.8
		No preference for cultural tourism	37.2
	Nature tourism	Preference for nature tourism	60.8
		No preference for nature tourism	39.2
	Rural tourism	Preference for rural tourism	33.9
		No preference for rural tourism	66.1
	Active/Adventure tourism	Preference for active/adventure tourism	20.6
		No preference for active/adventure tourism	79.4
	Interest	Personal interest	88.3
		Companion	11.7
	Prior knowledge of the site	Friends/acquaintances	45.4
		Internet	23.8
		Tourist Information Office	3.7
		Other reasons	14.9
		Printed press	11.7
		Accommodation recommendation	0.5
	Previous experience in other archaeological sites in the local area (Cuenca/Guadalajara)	Previous experience exists	38.7
		No previous experience	61.3
	Previous experience in other archaeological sites in Castilla-La Mancha	Once a year	6.9
		Two to three times a year	93.1
	Previous experience in other archaeological sites in Spain	More than three times a year	33.9
		Accessibility	66.1
	Previous experience in archaeological sites abroad	Toilets	6.4
		Vending machine (drinks/food)	93.6
	No previous experience in other archaeological sites	Maintenance	23.0
		Nothing to comment	77.0

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Tourist Profile: Frequency	Frequency	Parking	45.9
		Entry price	29.8
		Signage inside the site	24.3
Tourist Profile: Perceptions	Perception – Positive	Signage to reach the site	19.3
		Guided tour	10.5
		Self-guided tour	1.4
		Add extra service	15.8
		Insufficient (0–4)	0.7
		Sufficient (5)	22.9
		Good (6)	25.0
		Very good (7)	9.2
		Very good (8)	7.6
		Excellent (9)	91.5
		Excellent (10)	12.1
	Perception – Negative	Impact on the environment	4.4
		No impact on the environment	16.0
		Female	12.2
		Male	4.1
		Up to 31 years old	27.1
		From 32 to 44 years old	4.1
		From 45 to 54 years old	2.5
		From 55 to 62 years old	10.1
		Over 62 years old	27.8
		Local area (Cuenca/Guadalajara)	2.7
		Castilla-La Mancha	2.0
	Suggestions	Rest of Spain	51.1
Tourist Profile: Satisfaction after the experience	Overall evaluation	Abroad	0.7
		Tourist apartment	0.7
		Campsite	1.2
		Rural house	5.1
		Hostel	17.0
		Hotel	30.7
		Other	44.5

Source: Own elaboration.

5. Conclusions

The profile of tourists who visit archaeological sites located in sparsely populated rural areas presents a range of very heterogeneous

characteristics that explain their impact on the territory and the surrounding environment where the analyzed tourist resources are located. A total of five different age groups were analyzed, each displaying a distinct visitor profile based on age segment.

The age group up to 31 years old consists of a predominantly female young audience. A significant portion comes from the regional area, although origins from the rest of Spain and even international interest are also notable. This group mainly engages in day trips that include routes through the surrounding area. However, when taking trips with routes in the surrounding area, they tend to stay overnight in tourist apartments or campsites. They usually travel with family, but also with friends or partners, and even through organized trips related to academic training.

The 32 to 44 age group mostly comes from the regional and national surroundings and tends to prefer day trips over longer journeys, although they often include routes around the area as a pretext for visiting the site. Thus, this age group is predominantly composed of day-trippers and families who consume locally but have minimal impact in terms of overnight stays, where camper vans or converted vehicles stand out.

The 45 to 54 age group also comes from the surrounding areas and records the highest number of foreign visitors. This group is primarily composed of day-trippers who visit with family, partners, or alone. As such, day trips, often including routes in the surrounding area, are predominant. However, this group is split between those who limit their visit to the archaeological site and those who include broader regional routes. This duality—between day trip or extended travel with routes in both cases—is likely due to this group's life stage: either they have family responsibilities or have already moved past them.

Among the 55 to 62 age group, women are significantly represented, and visitors come not only from the region but also from the rest of Spain. While day trips are still prevalent, this group is the most likely to choose hotels when staying overnight. They often travel with friends or partners. This suggests that age does not necessarily equate to family responsibilities, or if it does, it is to a lesser extent. For this reason, both day trips with surrounding routes and extended trips including such routes are the most commonly chosen types of travel.

Finally, visitors over 62 years old, both men and women, visit out of personal interest. For this reason, their origins are more diverse, and they tend to stay in mainly residential accommodations. At the same time, their purchasing power allows them to choose hotels, and to a lesser extent, tourist apartments or alternatives like camper vans. This segment typically visits archaeological sites with friends, partners, or in organized groups. As a result, they are the largest group choosing either day trips with surrounding routes or longer trips with similar features.

In short, the analysis of the impact of cultural tourists in rural and sparsely populated areas reveals that the decisions made by tourists when visiting archaeological sites significantly affect the surrounding environment. In addition to archaeological tourism, other forms of tourism such as rural or nature tourism—also have an impact. Although they represent 40.1% of respondents, their impact on the environment remains high at 85.3%. This suggests that cultural tourism in general, whether motivated by archaeological interest or not, contributes to the development of local economies. Accommodations and tourist infrastructure, such as campsites and apartments, also play a central role in this dynamic, attracting 87.9% of visitors who generate benefits for the region.

The cultural tourist profile is diverse, highlighting both those with a strong preference for archaeological tourism and those motivated by curiosity or companionship. A significant 88.3% of respondents visit these places out of personal interest, demonstrating that internal motivations are key for tourism in rural areas. Word of mouth and digital media are crucial factors, with 45.4% of respondents discovering the sites through recommendations from friends and family. The internet also plays a significant role in promoting these destinations, being the preferred channel for 23.8% of tourists.

Regarding previous experience, most respondents (77%) had already visited other archaeological sites, reinforcing the idea that cultural tourists show high loyalty to this type of destination. Frequent visits, once or more per year, are common among tourists, contributing to a steady flow of visitors and, therefore, a sustained impact on local economies. This behavioural pattern highlights the importance of offering high-quality experiences that encourage repeat visits.

On the other hand, the evaluation of services offered at archaeological sites is key to understanding tourist satisfaction. Guided tours are the most highly rated, with 91.5% of positive feedback, underscoring the importance of providing enriching and educational experiences. However, other services, such as maintenance or signage within the site, received lower ratings, indicating areas for improvement that could further enhance the visitor experience and increase regional impact.

Despite some negative perceptions, such as inadequate signage for reaching the sites, tourists generally rate their experience as very satisfactory. A total of 75.2% give their visit an outstanding rating, reinforcing the idea that cultural tourism in rural areas is not only viable but also positively valued by visitors. This type of tourism offers development opportunities for local communities while preserving and promoting cultural and archaeological heritage.

Finally, future lines of research should focus on exploring how to optimize the tourist experience and improve the services offered by rural destinations. It would also be useful to delve deeper into the factors that influence the choice of these destinations and how promotional strategies can be improved to attract more international visitors. The synergy between different types of cultural tourism, archaeological, and nature tourism also deserves further study to maximize the positive impact on the rural environment. This study serves as a methodological reference for future research in other regions or countries with similar realities: low population density, high heritage value, and a need for sustainable development strategies.

6. Bibliography

- [1] Agnusdei GP, Miglietta PP, Pacifico AM, Malorgio G. Rurality as a driver of tourist demand in the Salento area: a systemic approach. *Rural Society*. 2024;1–16.
- [2] Alazaizeh MM, Hallo JC, Backman SJ, Norman WC, Vogel MA. Crowding standards at Petra Archaeological Park: a comparative study of McKercher's five types of heritage tourists. *Journal of Heritage Tourism*. 2016;11(4):364–81.
- [3] Alcalde G, Burch J. The Use of Archaeological Sites Presented as Museums. Context and Characterization of Visits to Such Sites in the Area of the Costa Brava. *COMPLUTUM*. 2015;26(2):175–85.

- [4] Ashraf J, Ali S, Nawaz MA, Ghufuran M. Tourist Intentions to Visit or Revisit Archaeological Sites in Pakistan. *Asian Journal of Social Science*. 2020;48(5–6):588–617.
- [5] Bălan M, Burghilea C. Rural Tourism and its Implication in the Development of the Fundata Village. *Procedia-Social and Behavioral Sciences*. 2015;188:276–81.
- [6] Baker DA., Crompton JL. Quality, satisfaction and behavioral intentions. *Annals of tourism research*. 2000;27(3):785–804.
- [7] Pérez D. Cultural Heritage Management of the Archaeological Zone of Huaycán and its impact on Tourism Development. *Revista San Gregorio*. 2020;(38):151–63.
- [8] Ercolano S, Gaeta GL, Parenti B. Pompeii dilemma: A motivation-based analysis of tourists' preference for "superstar" archaeological attractors or less renowned archaeological sites in the Vesuvius area. *International Journal of Tourism Research*. 2018;20(3):345–54.
- [9] Hernández Sampieri, Fernández-Collado, Baptista P. *Metodología de la investigación*. Vol. 6. México.: McGraw-Hill, 2014.
- [10] Hidalgo-Fernández A, Hernández-Rojas R, Jimber Del Río JA, Casas-Rosal JC. Tourist motivations and satisfaction in the Archaeological Ensemble of Madinat Al-Zahra. *Sustainability*. 2019;11(5).
- [11] Kerstetter DL, Confer JJ, Graefe AR. An exploration of the specialization concept within the context of heritage tourism. *Journal of Travel Research*. 2001;39(3):267–74.
- [12] Landero R, González M. *Estadística con SPSS y metodología de la investigación*. México: Trillas. 2006; 154–157.
- [13] Li H, Qian Z. Archaeological heritage tourism in China: the case of the Daming Palace from the tourists' perspective. *Journal of Heritage Tourism*. 2017;12(4):380–93.
- [14] Lin JH, Fan DX, Tsaur SH, Tsai YR. Tourists' cultural competence: A cosmopolitan perspective among Asian tourists. *Tourism Management*. 2021;83.
- [15] Mcgettigan F, Rozenkiewicz A. *Archaeotourism-the past is our future?* En: *Cultural tourism CABI Books*. 2013;118–28.
- [16] Mckercher B. Towards a classification of cultural tourists. *International Journal of Tourism Research*. 2002;4(1):29–38.
- [17] Mustafa MH, Balaawi FA. Evaluating visitor management at the archaeological site of Petra. *Mediterranean Archaeology & Archaeometry*. 2013;(1).
- [18] Nguyen THH, Cheung C. The classification of heritage tourists: A case of Hue city. *Vietnam Journal of Heritage Tourism*. 2014;9(1):35–50.
- [19] Rakitovac KA, Urošević N, Vojnović N. Creating innovative tourism experiences through sustainable valorisation of archaeological heritage. *Tourism in Southern and Eastern Europe*. 2019;5:1–15.
- [20] Richards G. The market for cultural attractions. *Cultural Attractions and European Tourism*. 2001;31–53.
- [21] Richards G. Production and consumption of European cultural tourism. *Annals of Tourism Research*. 1996;22(2):261–83.
- [22] Silberberg T. Cultural tourism and business opportunities for museums and heritage sites. *Tourism Management*. 1995;16(5):361–5.

- [23] Šťastná M, Vaishar A, Ryglová K, Rasovska I, Zamecnik S. Cultural tourism as a possible driver of rural development in Czechia. Wine tourism in Moravia as a case study. *European Countryside*. 2020;12(3):292–311.
- [24] Timothy DJ. Cultural heritage and tourism: An introduction. Channel View Publications; 2011.
- [25] Veal AJ. Research methods for leisure and tourism. 5a ed. Londres, Inglaterra: Pearson Education; 2017.

External factors affecting the environmental, social and economic performance of SME entrepreneurs in the retail sector: the case of Spain

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Abstract

The sustainable behavior of companies in the retail sector has become a strategic global priority due to its significant impact on supply chains, consumption patterns, and job creation. In the Spanish context, particular attention is required, as small and medium-sized enterprises (SMEs) in retail represent a fundamental component of the productive and social fabric. Their adaptation to sustainable practices is key to ensuring competitiveness, territorial cohesion, and economic resilience. However, these enterprises face multiple structural and contextual barriers that hinder their transition toward sustainable models.

This study analyzes how external factors—government support, legal regulations, market dynamics, and customer expectations—influence the sustainable behavior of SME retailers in Spain, considering pro-environmental, prosocial, and pro-economic dimensions. Based on

a sample of 100 business owners located in the cities of Cuenca and Valencia and employing partial least squares structural equation modeling (PLS-SEM), results revealed that legal frameworks exert a significant negative effect on sustainable behavior. In contrast, market and customer influences showed ambivalent effects—positive on environmental aspects and negative on social and economic ones.

These findings highlight the need to redesign public policies and programs to better align with SMEs' actual capacities. Moreover, the proposed model makes a valuable contribution to the academic literature on business sustainability by incorporating an external-contextual perspective that reveals the constraints and opportunities faced by small firms. This research lays conceptual and methodological groundwork for future studies that integrate internal and cognitive factors, aiming to achieve a more comprehensive understanding of sustainable behavior in the retail sector.

Keywords: Sustainability, Retail, PLS-SEM, Sustainable Behavior.

1. Introduction

The retail industry currently faces significant sustainability challenges, largely driven by the growth of global consumption and increasing pressure to adopt responsible practices [1–4]. In Spain, these challenges acquire relevance due to the limited information available on how small and medium-sized enterprises (SMEs) in the retail sector are integrating sustainable practices into their operations. This situation is especially concerning when considering that large international retail chains are leading the transformation through sustainable innovation investments, while SMEs remain behind in this structural shift [5,6].

Retail SMEs play a strategic role not only in supply chains but also as agents of territorial cohesion, cultural identity preservation, and local economic dynamism. Their exclusion from sustainability processes may exacerbate competitive inequalities and undermine their future viability. In response, the European Union, through the European Regional Development Fund (ERDF), allocated over €66 million between 2014 and 2021 to promote innovation, competitiveness, and sustainability, with a particular focus on SMEs. Nonetheless, structural barriers persist despite these institutional efforts. The main difficulties identified include

limited access to capital, shortage of qualified personnel, regulatory burdens, and geographic location of businesses [7].

Recent data from the Spanish National Statistics Institute [8] show that while a significant portion of companies in the sector have invested in technological innovation, there is a marked absence of indicators linked to environmental, social, and economic sustainability. This gap reveals that the innovation approach has not yet been fully aligned with sustainability objectives.

To address this issue, the present research is structured as follows: first, a literature review and theoretical framework (Section 2); second, the research model and methodology (Section 3); third, the empirical findings (Section 4); followed by a theoretical and interpretative discussion and finally, conclusions and recommendations (Section 5), offering both practical and theoretical implications for the sustainable development of retail SMEs in Spain. This structure aims to provide readers with a clear, coherent, and sequential understanding of the study's objectives, findings, and contributions.

2. Objective

Corporate sustainability in the retail sector has gained increasing importance in the academic literature over the past two decades due to the sector's strategic role in transitioning toward greener, more resilient, and inclusive economic models. As a direct point of contact with consumers, the retail industry can significantly influence sustainable production and consumption patterns, particularly in densely populated urban contexts. Within this sector, small and medium-sized enterprises (SMEs) face unique challenges in adopting sustainable practices despite their economic and social relevance [9,10].

The adoption of sustainability strategies in SMEs is influenced by both internal and external factors. Internal factors include the entrepreneur's attitude, level of technical knowledge, organizational culture, and availability of resources [11,12]. In contrast, external factors involve regulatory pressure, market demands, public incentives, and stakeholder expectations [7,13].

Various studies have shown that external factors can act both as drivers and barriers to sustainability, Gadenne et al. [9], found that regulatory pressure and stakeholder demands were key determinants in SMEs' adoption of environmental practices in Australia. Similarly, Salimzadeh [10] emphasized that regulatory environments and institutional support can either facilitate or hinder the implementation of sustainable practices depending on their clarity, stability, and accessibility.

From an organizational behavior perspective, Navarrete Báez [11] notes that many entrepreneurs exhibit a positive disposition toward sustainability but lack the resources, technical expertise, and support to translate this attitude into concrete actions. This gap between intention and behavior has been consistently identified in the literature, particularly in contexts where public action fails to align with the operational realities of the business sector [14].

In the European context, Henriques et al. [7] report that despite the existence of instruments such as the European Regional Development Fund (ERDF), SMEs encounter significant barriers to access, limiting their ability to innovate sustainably. In contrast, studies by Wasiq et al. [15] and Ernst et al. [16] highlight the growing role of consumer preferences and market pressures as drivers of sustainable change, although the effect varies depending on firm size, location, and organizational maturity.

This perspective is reinforced by Ernst et al. [16] and Nsowah and Phiri [17], who advocate for integrating more comprehensive theoretical models that simultaneously account for institutional, market, and internal organizational pressures. Their approach responds to the need for a more accurate understanding of the dynamics SMEs face when incorporating sustainable practices into their operations.

Despite these theoretical advancements, multiple structural barriers persist. According to Santos et al. [14] and Abumalloh et al. [18] common obstacles include lack of financing, informal human capital management, high tax burdens, deficient infrastructure, and unequal competition with large corporations. These conditions contribute to a heightened perception of risk, which discourages sustainable innovation [19–21].

Based on the theoretical review developed in the previous sections, this study proposes a structural model that analyzes the influence of external factors—specifically government support, legal and regulatory frameworks, and market and customer demands—on three dimensions of sustainable behavior among retail entrepreneurs: pro-environmental, prosocial, and pro-economic behavior. This model, grounded in both empirical and conceptual evidence, aims to offer a more comprehensive understanding of the conditions that facilitate or hinder the sustainable transition of retail SMEs. It also seeks to provide relevant insights for public policy design and the development of sustainable business strategies.

The following research hypotheses were formulated:

H1: Government support positively influences pro-environmental behavior.

H2: Government support positively influences pro-economic behavior.

H3: Government support positively influences prosocial behavior.

H4: Legal and regulatory frameworks positively influence pro-environmental behavior.

H5: Legal and regulatory frameworks positively influence pro-economic behavior.

H6: Legal and regulatory frameworks positively influence prosocial behavior.

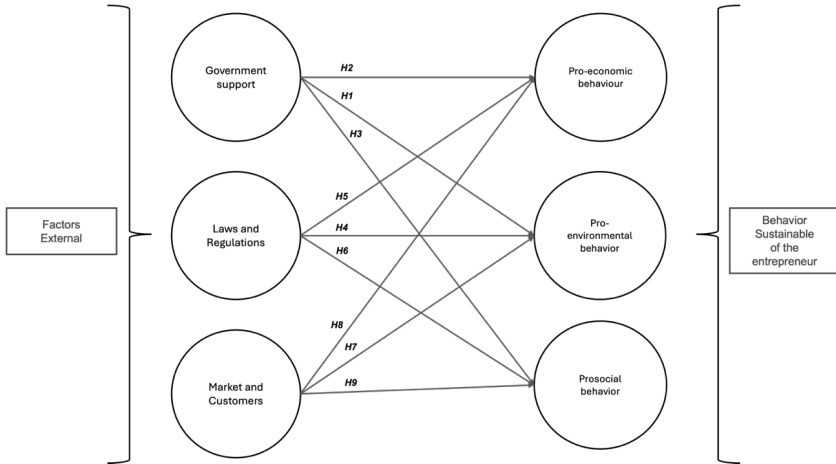
H7: Market and customer demand positively influence pro-environmental behavior.

H8: Market and customer demand positively influence pro-economic behavior.

H9: Market and customer demand positively influence prosocial behavior.

The proposed research model can be observed in the Figure 1.

Figure 1: Sustainable behavior model of the retail entrepreneur in the adoption of sustainable practices.



The variables and dimensions of the external factors influencing SME entrepreneurs' sustainable behavior are described in **Table 1**.

Table 1: Variables, dimensions and indicators of the conceptual model.

Variable	Dimension	Meaning	No. of items	Authors
Factors External	Market and Customers	Influence of the market and customer expectations on the adoption of sustainable practices.	4 items	Wasiq et sl., (15) Salimzadeh (10)
	Laws and Regulations	Impact of environmental regulations and laws on business operations.	3 items	
	Government Support	Financial and technical assistance provided by the government for sustainable practices.	2 items	

Variable	Dimension	Meaning	No. of items	Authors
Pro-environmental behavior	Energy efficiency	Practices and technologies implemented to reduce energy consumption in the company's operations	3 items	Navarrete Baez (11) Salimzadeh (10)
	Waste management	Implementation of programs and practices aimed at reducing, reusing and recycling the waste generated by the company		
	Environmental management	Adoption of policies, procedures and certifications that ensure that the company's operations are sustainable and environmentally friendly.		
Prosocial behavior	Community Engagement	Activities and efforts made by the company to get involved and contribute positively to the local community	3 items	
	Social and business commitment	It involves the practices and policies that the company implements to fulfill its corporate social responsibility		
	Partnerships and Collaborations	Cooperation and collaboration of the company with other organizations		
Pro-economic behavior	Transparency and Communication	Company practices to maintain open and transparent communication with its stakeholders (employees, customers, suppliers, community, etc.)	3 items	Navarrete Baez (11)
	Resource Management	Strategies and practices implemented by the company to efficiently and sustainably use available resources		
	Local Economic Development	Actions carried out by the company to contribute to the economic development of the local community		

3. Methodology

To empirically test the proposed hypotheses, a quantitative, explanatory, cross-sectional, and non-experimental research design was employed. The partial least squares structural equation modeling (PLS-SEM) technique was selected due to its suitability for exploratory research, complex models with multiple constructs, nonlinear relationships, and moderate or small sample sizes [22,23].

PLS-SEM is particularly useful in applied studies in the social and business sciences when the goal is to maximize the explained variance of dependent variables while obtaining robust estimations of both the measurement and structural models. Unlike the covariance-based approach (CB-SEM), PLS-SEM accommodates both formative and reflective constructs, non-normally distributed indicators, and causal relationships under more flexible statistical assumptions. It is also recommended when the main objective is prediction and the identification of significant relationships in complex real-world settings, such as the retail SME sector [24].

The study population consisted of retail entrepreneurs in the cities of Cuenca and Valencia, Spain. The sample was selected through non-probability convenience sampling, due to difficulties in accessing a comprehensive sampling frame, and consisted of 100 participants.

Data collection was carried out using a structured questionnaire, previously validated by experts. The instrument included five-point Likert scales to measure entrepreneurs' perceptions of the external factors and their sustainable behavior in three key dimensions: environmental, social, and economic.

Fieldwork was conducted in January 2025. The data were analyzed using SmartPLS 4.0 software [25]. To assess the measurement model, the following indicators were examined, composite Reliability (CR) to assess internal consistency; average variance extracted (AVE) for convergent validity; discriminant validity using the HTMT (Heterotrait-Monotrait Ratio) criterion, as recommended by Hair et al. [23]. All indicators were compared against thresholds established in the academic literature to ensure the model's validity and robustness.

4. Results

The descriptive analysis of the sample showed that 65% of participants were women and 35% men, indicating a higher female representation among retail entrepreneurs in the cities studied. Regarding age, a diverse distribution was observed: 22% were aged 18–25; 17% between 26–35; 18% between 36–55; 14% between 56–65; and 15% were over 65. As for educational level, most participants held university degrees: 6% had completed only secondary education, 16% had high school education, 61% held a bachelor’s degree, and 17% had completed a master’s degree.

To validate the structural model, construct reliability was confirmed using composite reliability (CR), with all values exceeding the recommended threshold of 0.700 [22]. Indicator loadings were also above the acceptable cutoff of 0.707, and variance inflation factors (VIF) remained below 3, suggesting the absence of multicollinearity among indicators. The corresponding results are shown in Table 2.

Table 2: Reliability and factor load (n = 100).

Latent variable	Item	Loading	VIF	CR
Government support	APG2	0.868	1.250	0.839
	APG3	0.832	1.250	
Laws and regulations	LYN1	0.820	1.512	0.846
	LYN2	0.864	1.688	
	LYN3	0.723	1.308	
Market and customers	MYC1	0.843	1.722	0.859
	MYC2	0.762	1.500	
	MYC3	0.745	1.652	
	MYC4	0.755	1.436	
Pro-economic behavior	CPE1	0.800	1.656	0.830
	CPE2	0.802	1.653	
	CPE3	0.757	1.168	
Pro-environmental behavior	CPA1	0.854	1.391	0.841
	CPA2	0.791	1.433	
	CPA3	0.750	1.481	
Prosocial behavior	CPS1	0.749	1.608	0.847
	CPS2	0.795	1.660	
	CPS3	0.870	1.352	

Subsequently, convergent validity was assessed by calculating the average variance extracted (AVE), with all latent variables exceeding the 0.500 threshold, supporting the internal consistency of the measurement model. Additionally, to evaluate discriminant validity, the heterotrait-monotrait ratio (HTMT) criterion was applied. All correlations between constructs remained below the critical values of 0.85 and 0.90, in line with methodological recommendations. These results are summarized in Table 3.

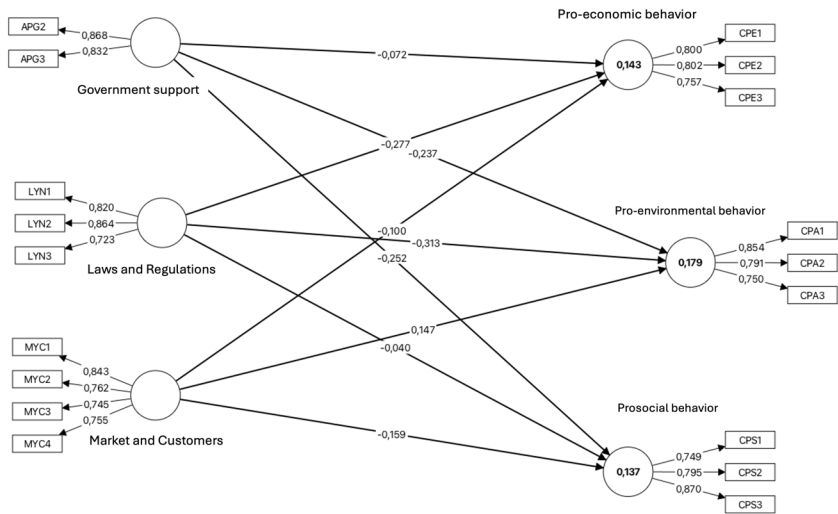
Table 3: Reliability of structural model consistency.

Latent variable	AVE	APG	CPA	CPE	CPS	LYN
Government support	*0.723					
Pro-environmental behavior	*0.639	0.492				
Pro-economic behavior	*0.619	0.371	0.734			
Prosocial behavior	*0.650	0.460	0.432	0.737		
Laws and regulations	*0.647	0.732	0.477	0.488	0.299	
Market and customers	*0.604	0.537	0.144	0.348	0.294	0.626

**Note: value of the square root of the AVE.*

Before estimating the structural model, collinearity among constructs was assessed using VIF values, which ranged from 1.382 to 1.525, remaining within acceptable thresholds. The explanatory power of the model was examined through the coefficient of determination (R^2), which represents the percentage of variance explained by the exogenous constructs. The values obtained were 0.179 for pro-environmental behavior, 0.125 for pro-economic behavior, and 0.137 for prosocial behavior. Although these values are considered modest, they are acceptable in exploratory studies with small sample sizes, as supported by Hair et al. [23]. The graphical representation of the adjusted model is shown in Figure 2.

Figure 2: Structural model (expost facto).



To evaluate the statistical significance and relevance of the path coefficients between constructs, the bootstrapping technique was applied using 5,000 subsamples and a two-tailed test with a 95% confidence level [26]. Path coefficients indicate the direction and strength of the relationships between variables: positive values suggest a direct relationship, whereas negative values indicate an inverse relationship.

The results show that government support exerts a negative and statistically significant effect on both pro-environmental behavior ($\beta = -0.237$; $p = 0.019$) and prosocial behavior ($\beta = -0.252$; $p = 0.005$). However, its influence on pro-economic behavior was not significant ($\beta = -0.072$; $p = 0.441$). In the case of laws and regulations, significant negative effects were observed on the pro-environmental ($\beta = -0.313$; $p = 0.002$) and pro-economic ($\beta = -0.277$; $p = 0.003$) dimensions, while the effect on the prosocial dimension was not significant ($\beta = -0.040$; $p = 0.686$).

On the other hand, factors related to the market and customers showed a positive influence on pro-environmental behavior ($\beta = 0.147$), although it was not statistically significant ($p = 0.111$). In contrast, their impact on the pro-economic ($\beta = -0.100$; $p = 0.322$)

and prosocial ($\beta = -0.159$; $p = 0.096$) dimensions was negative and not significant. These results are presented in Table 4.

Table 4: Hypothesis Test Results.

Hypothesis	Statistics t	P values	Result
H1. Government Support -> Pro-Environmental Behavior	2.348	0.019**	Validated
H2. Government Support -> Pro-Economic Behavior	0.771	0.441	Not validated
H3. Government Support -> Prosocial Behavior	2.808	0.005**	Validated
H4. Laws and regulations -> Pro-environmental behavior	3.175	0.002**	Validated
H5. Laws and regulations -> Pro-economic behavior	2.939	0.003**	Validated
H6. Laws and regulations -> Prosocial behavior	0.405	0.686	Not validated
H7. Market and customers -> Pro-environmental behavior	1.593	0.111	Not validated
H8. Market and customers -> Pro-economic behavior	0.991	0.322	Not validated
H9. Market and customers -> Prosocial behavior	1.667	0.096	Not validated

Note: ** $p < 0.05$, is significant.

Collectively, these findings reveal that external factors exert an ambivalent influence on business sustainability in retail sector SMEs. While regulatory demands and institutional support are often conceived as driving mechanisms, in practice they may produce adverse effects if not aligned with the firms' actual capacities. Similarly, market pressure—although potentially positive in environmental terms—does not appear to translate into perceived economic or social benefits. These observations reinforce the need to redesign public policy instruments and market strategies to more accurately respond to the heterogeneity and structural limitations of the retail business sector.

5. Conclusions

The findings of the PLS-SEM model reveal some counterintuitive trends. First, formal institutional pressures—such as laws, regulations, and government support—exert negative effects on the adoption of sustainable practices in the analyzed retail SMEs. In contrast, market and customer pressures display an ambivalent influence, that is, not exclusively positive or negative. The following section delves deeper into the interpretation of these results, integrating recent academic literature to explain their possible causes and consequences.

Regarding the role of legislation and regulations, the results suggest that rather than encouraging sustainability, they may be generating burdens or unintended effects on SMEs. Various studies indicate that many small firms perceive environmental regulations more as administrative and financial burdens than as catalysts for sustainable improvements [27,28]. For instance, an OECD report highlights that microenterprises often must devote more time and resources to demonstrating regulatory compliance (form-filling, audits, procedures) than to implementing actual environmental improvements. This imbalance can lead to negative effects: SMEs tend to adopt a defensive or “minimum compliance” approach to regulations, prioritizing the avoidance of sanctions over the pursuit of sustainable innovation opportunities [29]. In fact, these authors document an emblematic case in Chile, where strict environmental legislation on waste management exposed “practical limitations” for SMEs, which struggled to comply with the law due to a lack of resources and technical support. This reinforces the idea of a gap between the intention of public policy and the operational reality of businesses: regulations, often designed from a “one-size-fits-all” perspective, may be misaligned with the actual capacities of SMEs, even producing counterproductive outcomes in terms of effective sustainability [30].

A similar phenomenon is observed with government support. Although in theory public aid, subsidies, and sustainability promotion programs should facilitate the sustainable transition of small enterprises, our results indicate an overall negative effect associated with this construct. One possible explanation, supported by recent literature, is that the available government support is not

effectively reaching SMEs nor is it adapted to their needs, resulting in a perception of ineffectiveness or even dependency. Bakos et al. [31] for instance, found in a qualitative study that most SME managers reported that neither regulations nor government incentives significantly influenced their sustainability decisions. In other words, many small business owners feel that public sustainability programs “have little or no effect” on their operations. Several structural reasons may contribute to this outcome: (i) bureaucratic barriers and complex procedures to access aid; (ii) lack of dissemination or clarity regarding existing programs (many SMEs are not even aware of the available initiatives); and (iii) policy designs that fail to consider the specific characteristics of the retail sector. It is worth noting that some studies have even detected attitudes of distrust or apathy toward government assistance when it is perceived as insufficient or poorly designed [32,33]. Taken together, this may explain why in the model, SMEs with greater exposure to “government support” do not necessarily exhibit better sustainable practices—and in some cases even worse ones—possibly reflecting poor policy implementation or a lack of genuine commitment generated by such programs. These findings align with the notion that poorly targeted incentives may fail to motivate substantial changes and can even produce rebound effects (e.g., companies that comply solely to receive subsidies, abandoning efforts once the support ends).

On the other hand, the influence of the market and customers appears ambivalent in our estimations. This implies that commercial pressure does not act uniformly or consistently positively to drive sustainability in retail SMEs. The literature offers a nuanced view on this matter: on one hand, a growing segment of conscious consumers is acknowledged—those who value companies’ environmental and social responsibility—which could encourage SMEs to adopt more sustainable practices to meet this demand [32,34]. In fact, some small businesses find opportunities in green niches to differentiate themselves and add brand value. However, on the other hand, numerous studies show that most SMEs still perceive that the general market does not sufficiently reward sustainability to justify the required investments [18,35]. A meta-analysis of more than 30 studies concludes that neither customer nor supplier pressure has, on average, succeeded in driving significant green changes in SMEs.

This is partly due to the classic ambivalence of consumers: while in surveys many clients claim to prefer sustainable products, in practice their purchasing decisions are still primarily driven by price, convenience, and perceived quality, relegating sustainability to a secondary consideration [36,37]. In the Spanish retail sector—dominated by price competition and narrow profit margins—SMEs face the dilemma of balancing these opposing demands. Thus, it is not surprising that “market pressure” yields a mixed effect: in certain specific cases, customers or competitors may push toward responsible practices (e.g., demands from corporate buyers or eco-friendly trends in a niche market), but in most everyday situations, such external pressures are not strong or consistent enough to trigger general improvements in sustainability. This ambivalent result aligns with previous studies that report mixed findings regarding the impact of customer pressure on SMEs’ environmental management, often mediated by factors such as company size or industry sector [38]. In summary, the market sends contradictory signals: while some pioneering SMEs take advantage of an emerging green demand, many others perceive that the average consumer and the value chain still prioritize traditional criteria (price, speed) over sustainability, thereby generating a weak or erratic stimulus [17,39].

In an integrative manner, these findings reflect a concerning disconnect between the design of public policies and the operational reality of SMEs. The evidence suggests that current institutional initiatives—both coercive (laws, regulations) and supportive (incentives, aid)—are not achieving the intended effect in the context of small and medium-sized retail enterprises and may even generate outcomes contrary to those expected. Several authors have noted that “one-size-fits-all” policies often overlook the resource, knowledge, and organizational structure limitations inherent to SMEs, leading to a gap between regulatory intent and practical implementation [37,40,41]. For example, Revell and Blackburn [28] had already warned that many small firms perceive environmental regulations as unfair or disproportionate when compared to the demands placed on large corporations, generating resistance and distrust toward the public sustainability agenda.

Our empirical study confirms that this gap persists: regulatory pressure alone does not guarantee positive changes in retail SMEs and, when not accompanied by appropriate conditions, may result in

superficial compliance or ineffective administrative overload. Similarly, generic government support, if not attuned to the reality of small businesses (e.g., their limited capacity to absorb complex procedures, or the need for short-term results to ensure survival), is unlikely to lead to substantial improvements and may be disconnected from the internal motivations of these firms. This structural disconnect between policy and business reality explains why corporate sustainability cannot be driven solely by “regulatory pressure” or “market pressure.” Both, in their current forms, are insufficient: the former because it imposes formal requirements that SMEs comply with reactively and with difficulty, and the latter because it provides diffuse or inconsistent incentives that fail to permeate long-term strategic decisions.

Considering this situation, the need arises for more realistic and adaptive systemic approaches that combine intelligent institutional measures with the strengthening of internal capabilities and multi-actor collaboration. Specifically, the literature suggests several complementary courses of action. First, institutional incentives should be made more effective, which involves not only improving subsidies or tax benefits but also simplifying regulations (“smart regulation”) to reduce unnecessary burdens. For instance, the OECD advocates adjusting requirements based on company size and environmental risk, applying the “SME Test” when legislating—consulting SMEs and assessing impacts—and even adopting simplified regulatory regimes that prevent redundancies and overlapping procedures [42–44]. These reforms aim to ensure that regulations “resonate” with the realities of SMEs, offering clarity and facilitation rather than bureaucratic obstacles. Second, investing in training and technical assistance is essential. Numerous studies identify the lack of knowledge and skills as a key barrier preventing SMEs from advancing in sustainability [18,45,46]. Therefore, targeted training programs, sector-specific practical guides, and tailored advisory services can empower small entrepreneurs to understand how to incorporate ESG criteria into their daily operations.

The previously mentioned Chilean case illustrated the “need for technical support” for SMEs to comply with waste management regulations—something applicable to many other areas of corporate sustainability. Third, fostering collaboration and networks is strongly encouraged. SMEs do not operate in isolation; their sustainable

transition can be strengthened through cooperation with other actors: partnerships among companies (e.g., sustainable retail trade associations), participation in green supply chains led by large anchor firms, collaboration with academic institutions or technology centers for innovation, and public-private platforms that channel resources and knowledge toward small businesses [3,5,34,39,40,47–51].

These networks facilitate the sharing of best practices, the distribution of costs, and the achievement of economies of scale in sustainability projects that would be unfeasible individually. In summary, a systemic approach involves combining “sticks and carrots” in a balanced manner—smart regulation and well-designed incentives—with direct support actions—training, accessible financing, technical assistance—and co-creation spaces—sectoral working groups, sustainability clusters, etc.—so that sustainability ceases to be perceived as an external imposition and becomes integrated into SMEs’ business strategy.

This study emphasizes, therefore, that sustainability cannot be driven solely by regulatory pressure or market forces in isolation. A holistic approach is required, in which institutional frameworks stimulate and facilitate (rather than blindly impose), while enterprises develop internal capabilities and operate within a business environment that genuinely rewards responsible practices. Our findings offer useful implications for the redesign of public policy: policymakers should reconsider how regulatory and support instruments are structured in order to bridge the identified gap. For instance, more direct incentives could be implemented for sustainable SMEs (such as certification labels, preferential treatment in public procurement, or green soft loans), regulatory compliance could be simplified through digital tools tailored to small businesses, and efforts toward corporate sustainability should be made economically viable within the competitive retail sector.

Furthermore, these conclusions open future lines of research in the field of sustainability in the retail business sector. It will be valuable to deepen qualitative studies that explore SME owners’ perceptions of current policies, to evaluate pilot projects of integrated systemic approaches in controlled environments, and to conduct comparative analyses across different retail subsectors to identify successful practices. Ultimately, by shedding light on the disconnect

between institutional design and business reality, this research lays the groundwork for reorienting public and private strategies that catalyze authentic sustainability in retail SMEs, combining environmental responsibility with economic viability in a realistic and collaborative operational context.

The results of this research have confirmed that the sustainable behavior of retail sector entrepreneurs in Spanish SMEs is strongly influenced by external factors, whose nature and dynamics do not always act as drivers of change. Notably, both the regulatory framework and governmental support instruments show a negative influence on the environmental and social dimensions of business behavior, suggesting a disconnect between the design of public policies and the actual capacities of small firms to integrate such policies into their daily processes.

Likewise, it has been found that pressures arising from the market and customers exert an ambivalent influence: while they may serve as catalysts for environmentally sustainable practices, they do not produce clearly positive impacts in the social and economic dimensions. This imbalance reveals the urgent need to adopt a comprehensive sustainability approach that does not prioritize only the environmental dimension but instead structurally incorporates social objectives such as decent employment and community engagement, as well as economic goals aimed at efficiency, resilience, and the creation of local value.

From a strategic and public policy standpoint, the findings of this study highlight the urgency of designing differentiated and contextually adapted instruments that realistically respond to the heterogeneity of the retail business fabric. Public policies aimed at promoting sustainability in SMEs should consider not only regulatory aspects and financial incentives, but also technical training mechanisms, personalized assistance, and the creation of collaborative networks that enable companies to share resources, knowledge, and best practices. Moreover, it is essential to incorporate monitoring and evaluation mechanisms that allow for the continuous adjustment of these programs based on their effectiveness and the evolving context in which companies operate.

At the theoretical level, the structural model proposed in this work contributes to addressing a relevant gap in the literature on corporate sustainability, by focusing on a sector—the retail trade—and a type of enterprise—the SME—that has historically received less empirical attention in this area. The incorporation of an external-contextual perspective provides a better understanding of the tensions, constraints, and opportunities these organizations face in response to institutional, regulatory, and commercial pressures. This model can be replicated or expanded in future research that considers other mediating variables, such as dynamic capabilities, entrepreneurial values, or organizational culture.

From a research standpoint, it is considered pertinent to advance toward mixed and longitudinal methodological approaches that allow for the analysis of the evolution of sustainable behavior in SMEs in relation to transformations in their institutional and market environment. Qualitative studies that delve into the motivations, resistances, and perceptions of entrepreneurs will also be valuable for building a more comprehensive interpretive framework. Likewise, it will be crucial to examine the role of collaborative networks, frugal innovation, and public-private partnerships as strategies to strengthen sustainability in this type of enterprise.

In short, corporate sustainability in the retail SME sector cannot be understood as a linear response to regulation or market demand, but rather as the result of a complex interaction between structural, institutional, organizational, and human factors. Only through an integrated, interdisciplinary, and action-oriented approach will it be possible to turn small retail businesses into true agents of transformation toward a more just, resilient, and sustainable development.

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6. Bibliography

- [1] Abdelmoety ZH, Aboul-Dahab S, Agag G. A cross cultural investigation of retailers commitment to CSR and customer citizenship behaviour: The role of ethical standard and value relevance. Vol. 64, *Journal of retailing and consumer services*. The boulevard, langford lane, kidlington, Oxford ox5 1gb, Oxon, England: elsevier sci ltd; 2022.
- [2] Aksoy NC, Yazici N. Does justice affect brand advocacy? Online brand advocacy behaviors as a response to hotel customers? justice perceptions. Vol. 73, *Journal of retailing and consumer services*. The boulevard, langford lane, kidlington, oxford ox5 1gb, Oxon, England: elsevier sci ltd; 2023.
- [3] Brunen AC, Laubach O. Do sustainable consumers prefer socially responsible investments? A study among the users of robo advisors. *J Bank Finance*. marzo de 2022;136:106314.
- [4] Moshood TD, Nawanir G, Mahmud F, Mohamad F, Ahmad MH, AbdulGhani A, et al. Green product innovation: A means towards achieving global sustainable product within biodegradable plastic industry. *J Clean Prod*. agosto de 2022;363:132506.
- [5] Lu WM, Kuo KC, Tran TH. Impacts of positive and negative corporate social responsibility on multinational enterprises in the global retail industry: DEA game cross-efficiency approach. Vol. 74, *Journal of the operational research society*. 2-4 Park square, milton park, abingdon or14 4rn, Oxon, England: Taylor & Francis ltd; 2023. p. 1063-78.
- [6] Wang CH. Considering economic indicators and dynamic channel interactions to conduct sales forecasting for retail sectors. *Comput Ind Eng*. 1 de marzo de 2022;165:107965.
- [7] Henriques C, Viseu C, Neves M, Amaro A, Gouveia M, Trigo A. How Efficiently Does the EU Support Research and Innovation in SMEs? *J Open Innov Technol Mark Complex*. junio de 2022;8(2):92.
- [8] INE. 2022 [citado 7 de marzo de 2024]. INEbase / Ciencia y tecnología / Investigación y desarrollo / Encuesta sobre innovación en las empresas / Últimos datos. Disponible en: https://ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176755&menu=ultiDatos&idp=1254735576669#
- [9] Gadenne DL, Kennedy J, McKeiver C. An Empirical Study of Environmental Awareness and Practices in SMEs. *J Bus Ethics*. enero de 2009;84(1):45-63.
- [10] Salimzadeh P. Sustainable Practices in Small and Medium Sized Enterprises in Regional Australia [Internet] [Doctoral]. [Mount Helen, Australia]: University Drive; 2016. Disponible en: <https://core.ac.uk/reader/213007350>
- [11] Navarrete Baez FE. Las prácticas de desarrollo sustentable: un acercamiento descriptivo a las pequeñas empresas de Guadalajara, México. *Cuad Adm*. 19 de agosto de 2015;31(53):48-58.
- [12] Albors-Garrigos J. Barriers and enablers for innovation in the retail sector: Co-innovating with the customer. A case study in grocery retailing. *J Retail Consum Serv*. julio de 2020;55:102077.
- [13] Almeida L de, Esposito F, van Zeven J. When indicators fail electricity policies: Pitfalls of the EU's retail energy market Barrier Index. *Energy Policy*. 1 de junio de 2022;165:112892.

- [14] Santos AFD, Bittencourt VDS, Costa PRD, Sousa RCFD. Innovation efforts of companies in Latin American countries. *Int j res -granthaalayah*. 31 de julio de 2021;9(7):100-21.
- [15] Wasiq M, Kamal M, Ali N. Factors Influencing Green Innovation Adoption and Its Impact on the Sustainability Performance of Small- and Medium-Sized Enterprises in Saudi Arabia. *Sustainability*. 30 de enero de 2023;15(3):2447.
- [16] Ernst RA, Gerken M, Hack A, Hülsbeck M. SMES' reluctance to embrace corporate sustainability: The effect of stakeholder pressure on self-determination and the role of social proximity. *J Clean Prod*. febrero de 2022;335:130273.
- [17] Nsowah J, Phiri MA. Factors Influencing Adoption of Sustainable Supply Chain Management Practices Among Manufacturing Firms. *Int J Environ Sustain Soc Sci*. 4 de junio de 2023;4(3):822-31.
- [18] Abumalloh R, Nilashi M, Ooi K, Wei-Han G, Cham T, Dwivedi Y, et al. The adoption of metaverse in the retail industry and its impact on sustainable competitive advantage: moderating impact of sustainability commitment. *Ann Oper Res*. 27 de septiembre de 2023;
- [19] Bartels J, Reinders MJ, Van Haaster-De Winter M. Perceived sustainability initiatives: retail managers' intrinsic and extrinsic motives. Vol. 117, *British food journal*. Howard house, wagon lane, bingley bd16 1wa, w Yorkshire, England: emerald group publishing ltd; 2015. p. 1720-36.
- [20] Partida Sedas S, Sósol Sánchez S, González Reséndiz J de J. Integración de la sustentabilidad en la gestión empresarial dentro del municipio de Huatusco, Vera cruz. *Rev Ingeniantes*. 2019;1(1):3-7.
- [21] Thorisdóttir TS, Johannsdóttir L. Corporate Social Responsibility Influencing Sustainability within the Fashion Industry. A Systematic Review. *Sustainability*. 4 de noviembre de 2020;12(21):9167.
- [22] Hair Jr. JF, University of South Alabama, M. Hult GT, Michigan State University, M. Ringle C, Hamburg University of Technology, et al. *Manual de Partial Least Squares Structural Equation Modeling (PLS-SEM) (Segunda Edición)* [Internet]. 2nd Edition. OmniaScience; 2019 [citado 5 de junio de 2025]. Disponible en: <https://www.omniascience.com/books/index.php/scholar/catalog/book/108>
- [23] Hair Jr. JF, Ringle CM, Hamburg University of Technology (Germany), University of Waikato (New Zealand), Gudergan SP, University of Waikato, Castillo Apraiz J, et al. *Manual avanzado de Partial Least Squares Structural Equation Modeling (PLS-SEM)* [Internet]. 1.ª ed. OmniaScience; 2021 [citado 5 de junio de 2025]. Disponible en: <https://www.omniascience.com/books/index.php/scholar/catalog/book/128>
- [24] Henseler J, Ringle CM, Sarstedt M. Testing measurement invariance of composites using partial least squares. R. Sinkovics, Ruey-Jer "Bryan" Jean And Daekwan Kim R, editor. *Int Mark Rev*. 9 de mayo de 2016;33(3):405-31.
- [25] Ringle CM, Becker JM. *Smart PLS* [Internet]. Hamburgo: SmartPLS GmbH; 2020. (Versión 4). Disponible en: <http://www.smartpls.com>
- [26] Martínez Robles J, Real Paredes AR. Visual Merchandising y Atmósfera Comercial como determinantes de la Compra: Visual Merchandising and Retail Atmosphere as determinants of the Purchase. *Investig Adm*. 24 de marzo de 2025;54-1:1-15.

- [27] SMEs: Key drivers of green and inclusive growth [Internet]. 2019 mar [citado 11 de junio de 2025]. (OECD Green Growth Papers; vol. 2019/03). Report No.: 2019/03. Disponible en: https://www.oecd.org/en/publications/smes-key-drivers-of-green-and-inclusive-growth_8a51fc0c-en.html
- [28] Revell A, Blackburn R. The business case for sustainability? An examination of small firms in the UK's construction and restaurant sectors. *Bus Strategy Environ.* septiembre de 2007;16(6):404-20.
- [29] Villegas Pinuer FJ, Llonch Andreu J, Belbeze PL, Valenzuela-Fernández L. Waste Management. The Disconnection between Normative and SMEs Reality. *Sustainability.* 7 de febrero de 2021;13(4):1787.
- [30] Álvarez Jaramillo J, Zartha Sossa JW, Orozco Mendoza GL. Barriers to sustainability for small and medium enterprises in the framework of sustainable development: Literature review. *Bus Strategy Environ.* mayo de 2019;28(4):512-24.
- [31] Bakos J, Siu M, Orengo A, Kasiri N. An analysis of environmental sustainability in small & medium-sized enterprises: Patterns and trends. *Bus Strategy Environ.* marzo de 2020;29(3):1285-96.
- [32] Chiappetta Jabbour CJ, Seuring S, Lopes De Sousa Jabbour AB, Jugend D, De Camargo Fiorini P, Latan H, et al. Stakeholders, innovative business models for the circular economy and sustainable performance of firms in an emerging economy facing institutional voids. *J Environ Manage.* junio de 2020;264:110416.
- [33] Mahmood Z, Kouser R, Masud MdAK. An emerging economy perspective on corporate sustainability reporting – main actors' views on the current state of affairs in Pakistan. *Asian J Sustain Soc Responsib.* diciembre de 2019;4(1):8.
- [34] Alyahya M, Agag G, Aliedan M, Abdelmoety ZH. A cross-cultural investigation of the relationship between eco-innovation and customers boycott behaviour. *J Retail Consum Serv.* mayo de 2023;72:103271.
- [35] Ch TR, Awan TM, Malik HA, Fatima T. Unboxing the green box: an empirical assessment of buying behavior of green products. *World J Entrep Manag Sustain Dev.* 2021;17(4):690-710.
- [36] Gavrilă Gavrilă S, de Lucas Ancillo A. Spanish SMEs' digitalization enablers: E-Receipt applications to the offline retail market. *Technol Forecast Soc Change.* 1 de enero de 2021;162:120381.
- [37] Rodríguez-Espíndola O, Cuevas-Romo A, Chowdhury S, Díaz-Acevedo N, Albores P, Despoudi S, et al. The role of circular economy principles and sustainable-oriented innovation to enhance social, economic and environmental performance: Evidence from Mexican SMEs. *Int J Prod Econ.* junio de 2022;248:108495.
- [38] Uhlaner LM, Berent-Braun MM, Jeurissen RJM, De Wit G. Beyond Size: Predicting Engagement in Environmental Management Practices of Dutch SMEs. *J Bus Ethics.* septiembre de 2012;109(4):411-29.
- [39] Hou Y, Gao G. Pricing and manufacturing strategy of dual-channel green supply chain under common product competition. *BCP Bus Manag.* 12 de octubre de 2022;29:28-36.
- [40] Quaye D, Mensah I. Marketing innovation and sustainable competitive advantage of manufacturing SMEs in Ghana. *Manag Decis.* 8 de julio de 2019;57(7):1535-53.

- [41] Herman E, Zsido K. The Financial Sustainability of Retail Food SMEs Based on Financial Equilibrium and Financial Performance. *MATHEMATICS*. agosto de 2023;11(15).
- [42] Ali Asadullah M. Quadratic Indirect Effect of National TVET Expenditure on Economic Growth Through Social Inclusion Indicators. *SAGE Open* [Internet]. 2019;9(1). Disponible en: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85062449122&doi=10.1177%2f2158244019830557&partnerID=40&md5=8defd7297c641f809203398213933594>
- [43] Cesar da Silva P, Cardoso de Oliveira Neto G, Ferreira Correia JM, Pujol Tucci HN. Evaluation of economic, environmental and operational performance of the adoption of cleaner production: Survey in large textile industries. *J Clean Prod* [Internet]. 2021;278. Disponible en: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85090722908&doi=10.1016%2fj.jclepro.2020.123855&partnerID=40&md5=7639edbf8dba6e3819fd0a582b0e277>
- [44] McDougall N, Wagner B, MacBryde J. Competitive benefits & incentivisation at internal, supply chain & societal level circular operations in UK agri-food SMEs. *J Bus Res*. mayo de 2022;144:1149-62.
- [45] Adam M. The role of human resource management (HRM) for the implementation of sustainable product-service systems (PSS)-An analysis of fashion retailers. *Sustain Switz* [Internet]. 2018;10(7). Disponible en: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85050291942&doi=10.3390%2fsu10072518&partnerID=40&md5=1634b1e034664b73bd4c97d379e3d3e8>
- [46] Bai S, Wang Y. Green Investment Decision and Coordination in a Retailer-Dominated Supply Chain Considering Risk Aversion. *Sustainability*. 20 de octubre de 2022;14(20):13606.
- [47] Aliabadi V, Ataei P, Gholamrezai S. Identification of the relationships among the indicators of sustainable entrepreneurial ecosystems in agricultural startups. *J Innov Knowl*. octubre de 2022;7(4):100245.
- [48] Aydin N, Seker S, Deveci M, Ding W, Delen D. A linear programming-based QFD methodology under fuzzy environment to develop sustainable policies in apparel retailing industry. *J Clean Prod*. 10 de febrero de 2023;387:135887.
- [49] Attahiru YB, Aziz MMA, Kassim KA, Shahid S, Wan Abu Bakar WA, NSashruddin TF, et al. A review on green economy and development of green roads and highways using carbon neutral materials. *Renew Sustain Energy Rev*. 2019;101:600-13.
- [50] Athwal N, Wells VK, Carrigan M, Henninger CE. Sustainable Luxury Marketing: A Synthesis and Research Agenda. *Int J Manag Rev*. octubre de 2019;21(4):405-26.
- [51] Ara H, Yeap JAL, Hassan SH. Does going green really pay off? A sustainability performance view. *World Rev Entrep Manag Sustain Dev*. 2020;16(5):519-37.

Gender Inequality in Education and its Indirect Impact on Economic Growth through Vital and Demographic Variables in Chile

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Abstract

This study analyzes the indirect effects of gender inequality in education on economic growth in Chile, mediated through life expectancy at birth, infant mortality, and the total fertility rate. We rely on panel data from the 15 Chilean regions during the period 1990-2022, employing an econometric approach with Fixed Effects and Two-way models. The research is framed within Sustainable Development Goals (SDGs) 4, 5, and 10, emphasizing the relevance of incorporating a gender perspective in public policy analysis. The results show that gender inequality in education significantly affects these indicators, which in turn influence economic growth, highlighting the importance of inclusive educational policies to promote economic well-being.

Keywords: Gender inequality in education, infant mortality, life expectancy, total fertility rate, economic growth.

1. Introduction

Women's education plays a crucial role in human and economic development. Amartya Sen, Nobel laureate in Economics, emphasizes the importance of access to education and healthcare in improving quality of life, especially for women [1]. An educated woman is empowered, actively participates in family and community decisions, and contributes significantly to economic growth through human capital. Moreover, literature highlights that female education is linked to a reduction in fertility, infant mortality, and an increase in life expectancy at birth.

Recent research has deepened the analysis of gender inequality in education and its economic impact. In previous studies, we addressed the direct effect through human capital accumulation, and this work is a continuation of that [2], focusing on the indirect effect. Life expectancy at birth, infant mortality, and the total fertility rate are key indicators mediating the impact of education on economic growth. Knowles, Lorgelly, and Owen [3] and Lagerlöf [4] have shown that female education has a positive effect on production, but they also demonstrated that gender inequality in education can be a significant obstacle to economic development. For instance, high initial levels of gender inequality in education can lead to high fertility rates and low economic growth, creating a poverty trap that justifies public intervention.

Numerous studies confirm the relationship between female education and better child health. Hill and King [5] and Murthi, Guio, and Dreze [6] note that women's education has a significant impact on reducing infant mortality. Summers [7] emphasizes that investing in women's education yields high returns in terms of child health. Moreover, research by Barro and Lee [8] and King and Mason [9] indicates that greater female education leads to lower fertility rates, which favors long-term economic growth. Klasen [10] and Knowles, Lorgelly, and Owen [3] also find a positive correlation between female education and life expectancy at birth.

This study focuses on the Chilean regions and aims to identify and quantify the effect of gender inequality in education on life expectancy at birth, infant mortality, and the total fertility rate—variables that

explain regional growth differences [2,11]. Based on panel data from the 15 Chilean regions during the 1990–2022 period, the econometric analysis will employ Fixed Effects and Two-way models. This work is framed within Sustainable Development Goals (SDGs) 4, 5, and 10 and contributes to a deeper understanding of how educational and gender policies are crucial for the development of territories and sustainable economic growth by improving the vital statistics of the regions. It aims to contribute to the existing literature with a regional focus, highlighting the importance of inclusive educational policies to promote economic well-being in Chile.

2. Theoretical Framework

2.1. Importance of Women's Education: Direct and Indirect Effects

A country that achieves access to education and healthcare for all its citizens, even with low income, can achieve good results in terms of quality of life [1]. Sen emphasizes that education can have a more important effect on quality of life than other factors associated with a country's wealth. The role of women's education is particularly relevant. An educated woman is more empowered, can participate in decision-making at the family and community levels, has greater economic independence, gains more property rights and status, and improves her general position in social culture (pp. 264–265). Additionally, women's education has significant effects on development. Greater education allows women to participate in paid activities, increasing the country's income through human capital.

Klasen [10] emphasizes that theoretically, if it is assumed that boys and girls have innate abilities that are similarly distributed, and that those with more abilities are more likely to receive education, gender inequality in education means that less capable boys than girls have the opportunity to be educated. As a result, the innate ability of educated boys is lower than it would be if both boys and girls had the same opportunity. Assuming that human capital combines innate abilities and education, gender inequality would reduce growth by diminishing

potential human capital. This is called the direct effect of gender inequality in education on economic growth, and according to the author, this effect is also empirically demonstrated. Following this line, more educated women contribute to the increase of human capital in the next generation, improving both the quantity and quality of their children's education, and consequently, positively affecting economic growth [8,9,10,12].

The total effect of women's education and, consequently, gender inequality in education on growth comes from the sum of direct and indirect effects. These indirect effects are relevant for the development and quality of life of the population, which is why it is important to study them. The main or most developed ones in the literature are: infant mortality, fertility, and thus population growth, and life expectancy at birth.

2.2. Infant Mortality

Infant mortality, according to Sen and Brundtland [13], is the greatest example of a lack of freedom, as the things a person wishes to do can only be achieved with life, and thus, an early death is a basic denial of human freedom.

Several studies demonstrate that the education gap between men and women has repercussions on infant mortality. Countries with greater educational equity tend to have lower infant mortality rates and healthier populations [7,8,5,6,10]. Various studies conclude that women's education has a more powerful effect on social welfare than the income or education of the father. Considering that fathers and mothers have different preferences regarding family decisions and different income sources, the degree of participation of the mother in decisions may influence the level of resources invested in the children's education and health. It is understood that women tend to invest more in favor of children's health and the family in general [7,5].

Summers [7] emphasizes that investment in women's education yields the highest return in developing countries, helping to break the vicious cycle where greater ignorance leads to poverty, which in turn leads to higher infant mortality and fertility rates. Conversely, more educated women favor demographic situations as well as the

health and happiness of their families. According to King and Mason [9], a mother's education positively influences children's nutrition and immunization. The study reveals that, according to the latest demographic and health surveys in over 40 developing countries, the mortality rate of children under five is lower in households where the mother has primary education than in households where the mother has no education, and much lower in those where the mother has secondary education. Similar results are obtained when assessing children's immunization rates.

Murthi et al. [6], in their study of 296 districts in India, sought the factors impacting infant mortality and fertility. The results demonstrate that both male and female literacy have a broad negative effect on infant mortality, but only female literacy was statistically significant. The study also shows that other development variables such as male literacy, poverty reduction, urbanization, and access to medical facilities, although having positive effects on child survival, are relatively small compared to the effect of female literacy. Finally, it is also concluded that greater gender inequality tends to reduce women's power in society and thus negatively affect children's health and survival. This is understood in the same way as in Summers [7] and Hill and King [5], where children's health in India largely depends on women's initiative.

The empirical analysis of Hill and King [5] evaluated the effect of both women's education and gender inequality in education on social variables related to quality of life and growth. They concluded that an increase in primary education for women by 10 percentage points could translate into a reduction in infant mortality of around 4.1 deaths per 1,000 births. In the case of secondary education, the reduction could reach 5.6 deaths per 1,000 births. These results are obtained even when controlling GDP and other variables associated with infant mortality.

In 2004, Abu-Ghaida and Klasen [14] calculated the costs of not meeting one of the specific objectives proposed by the global community at the Millennium Summit to promote gender equity. This goal was to equalize primary and secondary schooling for men and women by 2005. Projections showed that countries far from meeting the proposed goal in 2005 would have reductions in their per capita

GDP of 0.1 to 0.3 percentage points. By 2015, it was estimated that the infant mortality rate would be higher by 14 per 1,000 for children under five. Similarly, higher rates of low-birthweight infants were projected (2.4 percentage points).

Finally, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO) [15], if all women received secondary education, infant mortality would be reduced by half.

2.3. Fertility and Population Growth

Women's autonomy increases with schooling, contributing to lower fertility rates [1]. Several empirical studies demonstrate the relationship between women's education and lower fertility rates, which translates into slower population growth, favoring economic growth [8,7,5,6,10,14,16]. The latter authors reveal that university education in the 1980s encouraged women to adopt non-traditional attitudes towards marriage and motherhood. It is expected that increasing both the quality and quantity of education, particularly for women, will reduce fertility, both by increasing the opportunity cost of children and by giving women greater control over their motherhood [17]. Goldin [18] refers to the fact that most of the current wage disparities between men and women occur within the same occupation, and at the same time, these disparities emerge primarily with the birth of the first child. All of the above causes a rethinking of motherhood, affecting current fertility rates.

Low fertility rates, in turn, would affect future dependency rates, increasing per capita income and reducing poverty [19]. In this regard, the empirical analyses of Bloom and Williamson [20] and Klasen and Lamanna [21] indicate that population growth has a purely transient effect on economic growth. This effect occurs only when the working-age population and dependent population grow at different rates. That is, if the working-age population grows faster than the dependent population, there will be a positive effect on economic growth, which the authors call the 'demographic gift.' The above coincides with the studies of Bloom, Canning, and Sevilla [22] and Canning et al. [19], who note that beyond population growth, changes in the age structure

of the population pyramid are what affect economic growth, which can be positive, negative, or neutral according to the authors.

Barro and Lee [24,8] evaluate the effect of education on variables that influence economic growth, such as fertility. The model used the logarithm of the total fertility rate for the period between 1965 and 1985 as the dependent variable, and years of female and male schooling, among other variables, as explanatory variables. The results show that the effect of education on fertility is different for men and women. In less developed countries, more female education leads to lower fertility rates, the opposite for men. In more developed countries, with higher educational levels, these results are reversed. In this regard, Dao et al. [23] highlight that improving gender equality in education increases the opportunity cost of raising children, thus reducing fertility.

Among the set of variables included in the study by Murthi et al. [6], only female literacy and women's participation in the labor force had a significant effect on fertility. Both effects were negative, meaning that greater agency or empowerment of women leads to lower fertility rates. The authors state that educated mothers are able to plan their families and thus decide how many children they wish to have, thanks to their greater knowledge and control over modern contraceptive methods. Referring to this work, Sen [1, p. 265] mentions, 'economic development may fall short of being "the best contraceptive," but social development—especially women's education and employment—can be very effective.

Several authors report that not only women's education but also the gender gap in schooling have a negative effect on fertility rates.

3. Materials and Methods

This section will detail the data sources and methods used to analyze the impact of gender inequality in education on key indicators such as life expectancy at birth, infant mortality, and the total fertility rate in Chilean regions.

3.1. The Data

This study uses the database structured in a previous work [2], which addressed the direct effect of gender inequality in education on economic growth. The database was built using secondary data sources, such as the National Socioeconomic Characterization Survey (CASEN), the Central Bank of Chile, and the National Institute of Statistics. These sources provide reliable, gender-disaggregated data, essential for a detailed and differentiated analysis of the realities of men and women in the educational, economic, and demographic contexts in Chile.

Table 1 provides a descriptive statistical analysis of various variables in a panel data set, broken down into three components: overall, between, and within. The analysis shows how these variables vary between regions and within each region over time.

For example, the schooling ratio (*ratioesci*), which shows the difference in average years of schooling between women and men, has an overall mean of 0.96, with low variability within regions, lower than other educational variables such as the secondary schooling ratio or average or higher schooling levels of men and women. The average life expectancy in the Chilean regions is 77.36 years; the average total fertility rate is 2 children per woman, just below the replacement rate of 2.1. On the other hand, the average infant mortality rate is 7.84 deaths per 1,000 births. This last variable shows the greatest differences between regions in the country. Finally, the logarithm of initial GDP per capita (*8.72*) shows stability across regions, reflected in its low variability.

Table 1: Descriptive Analysis of the Main Study Variables.

Variable	Statistic	Mean	Std. Dev.	Min.	Max.
tcaaspibpc	overall	2.87	2.66	4.21	11.69
	between	2.84	1.12	0.81	5.31
	within		2.24	-6.47	7.42
lnpibibi	overall	8.72	0.54	7.64	10.16
	between	8.71	0.45	8.06	9.91
	within		0.27	-0.7	0.57
ratioesci	overall	0.96	0.03	0.91	1.06
	between	0.96	0.02	0.94	1.02
	within		0.02	-0.04	0.04
escpromf	overall	9.37	1.07	7.13	11.37
	between	9.42	0.84	8.32	10.75
	within		0.73	-1.29	1.23
escpromh	overall	9.74	1.18	7.18	11.9
	between	9.79	1.02	8.2	11.19
	within		0.66	-1.21	1.18
escsuppromf	overall	12.03	4.33	4.6	24.71
	between	12.2	2.32	9.12	17.71
	within		3.76	-7.38	8.48

Variable	Statistic	Mean	Std. Dev.	Min.	Max.
escsuppromh	overall	12.49	4.69	5.01	26.3
	between	12.66	3.2	7.96	20.21
	within		3.48	-6.97	9.09
evivi	overall	75.31	4.01	66.36	80.62
	between	75.56	1.5	73.82	78.84
	within		3.83	-7.69	5.09
mi_lj	overall	9.95	4.64	5.84	26.6
	between	9.71	1.59	6.37	12.75
	within		4.25	-5.8	13.85
tgfin	overall	2.22	0.36	1.72	3.26
	between	2.21	0.18	1.88	2.52
	within		0.32	-0.44	0.83
vardeempl	overall	-0.48	3.84	-9.21	6.8
	between	-0.59	1.04	-2.83	0.85
	within		3.9	-6.78	7.59
pctpobiru	overall	17.13	12.78	1.2	40.7
	between	17.21	12.79	1.52	34.97
	within		2.13	-4.85	7.11

3.2. Methodology

As explained in the previous section, we will work with the database previously constructed, using three distinct dependent variables, which will be explained by GDP per capita, the schooling of men and women, and gender inequality in education (average, secondary, or higher schooling ratio). For the analysis, Fixed Effects and Two-way models will be applied. Two-way models allow for capturing variations both between regions and over time, which is crucial to understand how female education influences economic growth in different temporal and regional contexts.

We work with the period from 1990 to 2022, divided into six sub-periods: 1990-1996; 1996-2003; 2003-2009; 2009-2013; 2013-2017; and 2017-2022. Therefore, the final variables represent the last year of each period, while the initial variables represent the first year of each period. In this way, we analyze causality between the studied variables. The general formula for the Two-way model is as follows:

$$Y_{i,t} = \gamma_i + \beta_1 \text{GDP}_{pc,i,t-1} + \text{GIE}_{i,t-1} + \delta_i + \epsilon_{i,t} \quad (1)$$

Where:

Y_{i,t} = Infant Mortality, Life Expectancy, or Total Fertility Rate of region *i* at the end of period *t*.

GDP_pci,t-1 = Natural logarithm of GDP per capita of region *i* at the beginning of period *t* (end of period *t-1*).

GIE_{i,t-1} = Variable representing gender inequality in education in region *i* at the beginning of period *t* (end of period *t-1*).

EDUC_{i,t} = Average education by gender in region *i* during period *t*.

γ_i = Vector of dummy variables for each region (represents fixed regional effects).

δ = Vector of dummy variables for each period (represents fixed time effects).

β = Coefficient of the predictor variable.

ε_{i,t} = Error term.

In the analysis of the models, several validation techniques were implemented to ensure the robustness and reliability of the results obtained. One of the fundamental tests used was the Hausman Test, which determines the consistency and efficiency of random effects compared to fixed effects. When the result of this test is significant, it suggests that the fixed effects model is more appropriate. Conversely, if the result is not significant, it indicates that the random effects model is suitable for the case at hand.

To compare models, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were used. These criteria help assess the quality and fit of the models, where lower values indicate a better balance between model fit and complexity. A model with lower AIC and BIC values is preferred, as it suggests better performance without overfitting the data.

Finally, robust standard errors were applied to correct potential issues of heteroskedasticity and autocorrelation in the data. This allowed for more reliable coefficient estimates, ensuring that the conclusions drawn from the analysis were sound and based on accurate data. These validation techniques, integrated into the methodology, guarantee that the models used are appropriate and that the results

obtained are robust and reliable for interpretation and informed decision-making.

4. Estimations and Results: Vital Variables as Dependent Variables

Two-way econometric models and various tests will be employed to ensure the robustness of the results. This approach will help uncover the indirect effects of female education on regional economic growth, providing a deeper understanding of how educational and gender policies can promote development.

The following three tables present evidence on the effect of gender inequality in education, as well as the individual effect of the schooling of men and women on two vital variables: infant mortality (IM) and life expectancy (LE); and one demographic variable: the total fertility rate (TFR). These variables were previously demonstrated to be determinants for understanding growth differences between Chilean regions. Our prior study [2] showed that, for Chile, higher infant mortality reduces growth, while life expectancy is positively related to growth. On the other hand, unlike what usually happens in developing countries, in Chile, the total fertility rate positively impacts economic growth, which is closely related to the population aging process in the country, as is the case in developed countries.

The goal of this work is not to find the best model to explain the three previously mentioned variables but to present the best estimations incorporating our main study variables, which are gender inequality in education and schooling. The Two-way fixed effects model (controlled for heteroscedasticity and autocorrelation) is used. Through a restrictive F-test, it is confirmed that it is better to use a Fixed Effects model rather than estimate by Ordinary Least Squares. Likewise, the Hausman test was applied, which showed that for each equation, Fixed Effects (FE) were more efficient than a Random Effects (RE) model.

Table 2 (FE model) and Table 3 (Two-way model) use the Total Fertility Rate (TFR) at the end of each period as the dependent variable. Following the example of Barro and Lee [8], various

squared variables are tested to see if there is a nonlinear relationship between initial GDP per capita and average schooling on the TFR. These authors also propose that TFR is linked to both LE and IM. As mentioned in Section 2, higher LE would make having children more attractive but also imply that fewer births are required to generate a certain number of children who survive into adulthood. Meanwhile, higher IM implies greater costs in raising children, discouraging fertility, but at the same time increasing the number of births needed to achieve a certain number of survivors.

Table 2: Dependent Variable: Total Fertility Rate (TFR), Fixed Effects (FE) Model.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
lnpibib1	−0.7793***	−0.3263*	−0.2952*	−0.3753**	−0.3550**	−0.3041*
ratioesci	−35.0407	−	−43.7356*	−	−38.5393	−42.4702
ratioesci2	17.7792	−	23.3295*	−	20.3522	22.6128
escsupromf	−	−0.0380***	−0.0405***	−	−	−0.0302
escsuppromh	−	−	−	−0.0393***	−0.0405***	−0.0109
varev	−0.0011	−0.0250**	−0.0213*	−0.0240**	−0.0209**	−0.0215*
varmi	−0.0369***	−0.0378***	−0.0373***	−0.0383***	−0.0378***	−0.0374***
R ²	0.7707	0.8642	0.8717	0.8637	0.8681	0.8722
Adjusted R ²	0.756	0.8573	0.8617	0.8568	0.8578	0.8605
AIC	−51.7775	−97.774	−98.5754*	−97.4766	−96.2313	−96.9139
BIC	−39.6234	−88.0508*	−83.9905	−87.7534	−81.6464	−79.8981

The results under the FE model show that regions with higher initial GDP per capita also have lower fertility rates (no quadratic relationship is observed). According to Barro and Lee [8], countries with higher income levels tend to substitute quality for quantity of children, and there is greater awareness of birth control. Apparently, this also applies to Chilean regions.

The secondary school enrollment ratio shows a significant quadratic effect on the TFR. This result is consistent across all models. It is also observed that both the variation in infant mortality and life expectancy are negatively related to TFR. Furthermore, there is a negative, consistent, and significant relationship between higher education—both for women and men—and TFR. However, in both cases, this significance disappears in the presence of the gender equality in education variable. Our findings differ from those of Barro and Lee [8], who found different results for men and women.

Table 3 (Two-Way Model) shows that GDP per capita loses significance in the presence of time variables. Models I and VI perform best, as they present the lowest values of the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), indicating they are the most efficient and best-fitting models.

The models confirm the relationship between gender inequality in education and fertility. In Model I, the parameter for the school enrollment ratio shows a coefficient of -24.67, indicating that an increase in this ratio is associated with a significant decrease in regional total fertility rate. On the other hand, the coefficient for the squared enrollment ratio (ratioesci2) is 13.12, suggesting a quadratic relationship where the fertility rate decreases up to a certain point of the enrollment ratio and then begins to rise. This reflects the existence of a turning point in the relationship between education and fertility. From a certain level of equality (approximately 0.94), fertility rates begin to increase, which is currently beneficial for the growth of Chilean regions.

Finally, regarding fixed time effects, the F-test for the joint significance of the time variables in the model confirms their relevance. It is observed that fertility rates in Chilean regions have been decreasing over time, showing a notable decline in recent years [25,26] regarding the demographic transition process in Chile. In these equations, gender equality in education proves to have a greater impact on the TFR than male and female schooling individually.

Table 3: Dependent Variable: Total Fertility Rate (TFR), Two-Way Model.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
lnpibibi	0.1544	0.1138	0.1273	0.0715	0.0874	0.1121
ratioesci	-24.6726**	-	-28.8666**	-	-25.8010*	-28.1341*
ratioesci2	13.1234**	-	15.3284**	-	13.6191*	14.9106**
escsupromf	-	-0.0182	-0.0196	-0.0184	-0.0179	-0.0144
escsuppromh	-	-	-	-	-	-0.0060
1996-2003	-0.4705***	-0.4240***	-0.4105***	-0.4201***	-0.4136***	-0.4074***
2003-2009	-0.8275***	-0.7295***	-0.7202***	-0.7225***	-0.7229***	-0.7138***
2009-2013	-0.7685***	-0.6140***	-0.6124***	-0.6029***	-0.6132***	-0.6019***
2013-2017	-0.9551***	-0.7360***	-0.7296***	-0.7190***	-0.7308***	-0.7145***
2017-2022	-1.2383***	-0.9189***	-0.9133***	-0.9188***	-0.9380***	-0.8992***
R ²	0.9417	0.9437	0.9465	0.944	0.9459	0.9466
Adjusted R ²	0.9355	0.9386	0.94	0.9389	0.9393	0.9393
AIC	-160.8145	-165.8081	-166.0456	-166.2556*	-165.1091	-164.2517
BIC	-141.368	-148.7923	-144.1683	-149.2399*	-143.2318	-139.9436

Tables 4 and 5 use infant mortality (IM) at the end of each period as the dependent variable. In both cases, we observe a negative relationship between GDP per capita and infant mortality (IM), meaning that higher income levels reduce the mortality rate of children under one year of age.

Table 5 also included the variable $\text{LN}(\text{GDPpc}_i)^2$, revealing that the effect of GDP per capita on IM is nonlinear. This is an unconventional result, influenced solely by the Antofagasta region—a mining region that, although it has the highest GDP per capita each year, has experienced a slower reduction in infant mortality compared to other regions, particularly during the periods 1996–2003 and 2003–2009. If these two observations are removed, the results do not change significantly, except that GDP per capita no longer has a quadratic effect and remains consistently negative. In other words, income contributes to lower infant mortality rates.

Table 4: Dependent Variable: Infant Mortality (IM), Fixed Effects (FE) Model.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
lnpibibi	-6.5850***	-5.7210***	-5.7934***	-6.0389***	-6.1017***	-5.6437***
ratioesci	38.9014	-	43.6045	-	41.6366	42.5605
ratioesci2	-22.2129	-	-24.7209	-	-23.7124	-23.7751
escpromf	-	-0.2106	-1.2667	-	-0.7040	-8.5327
escpromf2	-	-0.0004	0.0515	-	-0.0259	0.3584
escpromh	-	-	-	0.5839	-	7.1877
escpromh2	-	-	-	-0.0361	-0.2885	-0.2885
R ²	0.717	0.702	0.720	0.7013	0.7182	0.7254
Adjusted R ²	0.7064	0.6908	0.702	0.6901	0.7001	0.7001
AIC	267.6843*	272.0198	270.7865	272.201	271.324	273.1414
BIC	274.9768*	279.3123	282.9406	279.4934	283.478	290.1571

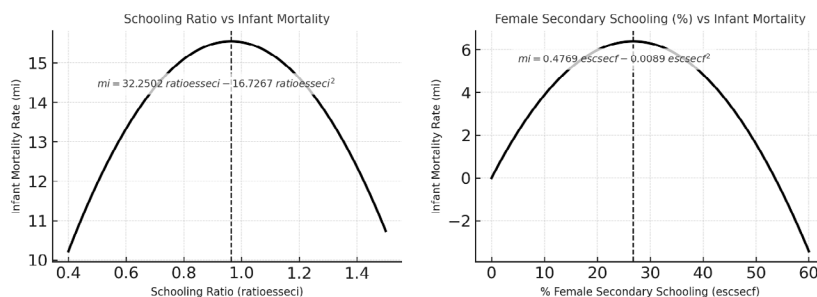
A quadratic effect between gender equality and infant mortality is also observed. This means that, beyond a certain level of equality, it contributes to reducing infant mortality rates. These variables are only significant in the Two-Way models.

Models III to IV (Table 5) are those with the lowest AIC and BIC values. For example, Model III shows that the initial school enrollment ratio (ratioesci) has a coefficient of 32.25, and its square (ratioesci²) has a coefficient of -16.72, indicating a quadratic relationship in which infant mortality increases with the enrollment ratio up to a turning point (0.96), after which it decreases (see Graph 1). In other words, regions with greater gender equality in education show lower infant mortality rates.

Similarly, the initial percentage of female secondary schooling has a turning point (26.79%), after which it also has the expected effect on infant mortality. Models that analyze the individual effect of male schooling reveal similar results.

Table 5: Dependent Variable: Infant Mortality, Two-Way Model.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
lnpibibi	-4.6009	-16.3321**	-19.0289**	-25.3973**	-27.8718**	-27.0797**
lnpibibi2	0.1825	0.8234**	0.9633**	1.3428**	1.4675**	1.4132**
ratioeseci	34.1750*	-	32.2502*	-	30.5233*	30.1049*
ratioeseci2	-	-	-16.7267*	-	-15.9433*	-15.8618*
escsecfi	-	0.4769**	0.4227**	-	-	0.3025
escsecfi2	-	-0.0091**	-0.0084**	-	-	-0.0056
escsech	-	-	0.4899**	0.4899**	0.4841**	0.2484
escsech2	-	-	-0.0095***	-0.0095***	-0.0092**	-0.0052
1996-2003	-4.0126***	-3.9599***	-3.8709***	-3.7683***	-3.7518***	-3.7494***
2003-2009	-4.3815***	-4.4618***	-4.2143***	-4.0972***	-4.0357***	-4.0520***
2009-2013	-4.8578***	-4.7768***	-4.4908***	-4.3290***	-4.3069***	-4.3007***
2013-2017	-4.5797***	-4.4124***	-4.0721***	-3.9361***	-3.8855***	-3.8583***
2017-2022	-5.4187***	-5.0644***	-4.7547***	-4.6554***	-4.6452***	-4.5474***
R ²	0.8929	0.8993	0.9048	0.9003	0.9052	0.9076
Adjusted R ²	0.8798	0.887	0.8903	0.8881	0.8907	0.8904
AIC	198.0886	192.8997	192.157	192.0787	191.8466*	193.6698
BIC	219.966	214.7771	218.8959	213.9561*	218.5856	225.2704

Figure 1: Relationship between secondary schooling/ high school attainment ratio and infant mortality.

Equation VI shows that, when the ratio and secondary schooling for women and men are used together, equality prevails over the other education variables. While all retain their signs, only the ratio is significant at a 90% confidence level. The time fixed effects show that infant mortality decreases in each period, a desired outcome in any society.

Finally, Table 6 and Table 7 use life expectancy at birth (LE) at the end of each period as the dependent variable. GDP per capita has a quadratic effect on LE, meaning that regions with higher incomes at the beginning of each period tend to be regions with

higher LE. The negative sign of the quadratic effect is a mystery to authors such as Barro and Lee [8], but we can infer that it is related to the epidemiological transition, where deaths are associated with diseases specific to the developed world such as diabetes, obesity, hypertension, etc.

We also identified a quadratic relationship between gender equality in education and life expectancy, suggesting that after a certain inflection point, higher levels of schooling ratios begin to increase life expectancy. For example, considering Model VII (two-way), the initial schooling ratio (*ratioesci*) has a coefficient of -34.49 (not significant), indicating that an increase in this ratio is associated with a decrease in life expectancy. However, the coefficient of its square (*ratioesci2*) is 21.27 (significant), suggesting a quadratic relationship where, after a certain inflection point, higher levels of schooling ratios begin to increase life expectancy. The inflection point is approximately 0.81.

Table 6: Dependent Variable: Life Expectancy, FE Model.

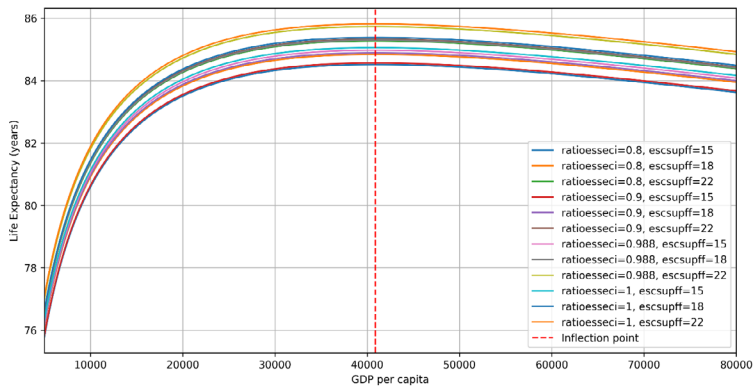
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<i>lnpibibi</i>	42.2398***	37.7337***	41.5259***	40.9625***	44.5013***	47.1202**	30.6116
<i>lnpibibi2</i>	-1.8892**	-1.7712**	-1.9668**	-1.9597**	-2.1390**	-2.2775**	-1.4370
<i>ratioesci</i>	-32.7183	-	-34.7701	-	-34.9487	-34.8751	-34.4907
<i>ratioesci2</i>	20.1048	-	20.7965*	-	20.6559*	20.4597*	21.2698*
<i>escsuppromh</i>	-	-	-	0.1753***	0.1622***	0.3007	0.0863
<i>escsuppromf</i>	-	0.1497**	0.1405**	-	-	-0.1355	-0.1641
<i>escpromf</i>	-	-	-	-	-	-	-0.7218
<i>escpromh</i>	-	-	-	-	-	-	2.3297
<i>R</i> ²	0.8428	0.85	0.863	0.8558	0.867	0.8682	0.8803
Adjusted <i>R</i> ²	0.8348	0.8444	0.8542	0.8504	0.8585	0.8579	0.8675
AIC	270.8391	264.8808	261.2463	261.5766	258.7703	260.0332	255.9558*
BIC	280.5624	272.1732	273.4004	268.869*	270.9244	274.6181	275.4023

Table 7: Estimation: Schooling and Life Expectancy, Two-Way Model.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lnpibibi	12.6138***	12.4227***	13.2359***	14.2815***	14.8382***	13.1701***	13.2194***
lnpibibi2	-0.7475***	-0.7362***	-0.7759***	-0.8310***	-0.8581***	-0.7726***	-0.7803***
ratioseseci	-2.6261	-	-4.2210	-	-4.4485	-4.1955	-3.8592
ratioseseci2	2.0660	-	2.7189	-	2.7771	2.7097	2.6060
escsuppromh	-	-	-	0.0890***	0.0790***	-0.0029	-0.0276
escsuppromf	-	0.0987***	0.0912***	-	-	0.0936**	0.1165**
escpromf	-	-	-	-	-	-	-0.6274
escpromh	-	-	-	-	-	-	-0.5639*
1996-2003	5.2484***	5.0328***	4.9885***	5.0232***	4.9978***	4.9909***	5.0356***
2003-2009	6.7192***	6.2873***	6.2360***	6.2850***	6.2618***	6.2403***	6.3608***
2009-2013	7.7088***	7.0242***	6.9938***	7.0298***	7.0359***	7.0000***	7.1896***
2013-2017	8.6514***	7.6115***	7.6099***	7.6259***	7.6711***	7.6188***	7.8995***
2017-2022	9.2671***	7.7476***	7.7680***	7.8944***	7.9679***	7.7768***	8.1740***
R ²	0.9916	0.9926	0.9930	0.9923	0.9926	0.9930	0.9933
Adjusted R ²	0.9905	0.9918	0.9920	0.9914	0.9915	0.9919	0.9922
AIC	35.1964	22.1033	21.4836*	25.9211	26.4894	23.4879	24.0094
BIC	57.0737	41.5768*	45.7918	45.3677	50.7975	50.2179	55.8147

Additionally, Figure 2 shows the relationship between GDP per capita and life expectancy, considering different levels of ratios esseci and escsupff, as well as their quadratic effects. The curves have the shape of an inverted parabola, indicating that life expectancy increases with GDP per capita until reaching a turning point, after which further increases in GDP per capita contribute increasingly less to life expectancy and may even reduce it slightly. This behavior reflects the presence of diminishing returns in the relationship between income and health. The curves shift upward as ratios esseci increase, indicating that a higher ratios esseci are associated with longer life expectancy. The quadratic term ratioseseci2 has a negative coefficient, implying that there is a point beyond which further increases in ratioseseci have a diminishing effect on life expectancy.

Figure 2: Relationship Between GDP per Capita and Life Expectancy.



In summary, both GDP per capita and initial and female education levels significantly influence life expectancy, with nonlinear effects that reflect diminishing returns. Increases in ratioesseci and escsupff improve life expectancy, but the marginal benefits decrease at higher levels of these factors. The turning point for GDP per capita—approximately 40 million Chilean pesos (annually)—highlights the optimal level at which life expectancy is maximized. The results are robust and show that both female and male education are significant factors in improving national development. However, it is essential to emphasize that equity is also a relevant factor in explaining differences in life expectancy across Chilean regions.

To conclude, while empirical findings in the literature often point to a stronger impact of female education on growth not only due to increased human capital, but also because of better child nutrition, prenatal care, and knowledge of birth control, our empirical results emphasize that both female and male education are important for economic growth and development. Consistent with the findings of Hill and King [27,5], Knowles et al. [3], Tena et al. [28], Klasen [10], and Tansel and Güngör [29], among others, our results demonstrate that gender equality in education is a desirable goal for the Chilean economy and a driver of individual well-being across regions. Gender equality is especially important when evaluating indirect effects, as in most cases it proves to be more influential than the individual effect of male or female schooling.

5. Conclusions

Previous studies have shown that education is a key factor in understanding regional economic growth differences in Chile. They also demonstrate that educational disparities between women and men hinder growth through the accumulation of human capital—referred to here as the direct effect. This study provides robust evidence of the significant indirect effects of gender inequality in education on economic growth in Chile, mediated through life expectancy at birth, infant mortality, and the total fertility rate. The results show that greater gender equity in education not only improves these vital and demographic indicators, but also has a positive and significant impact on regional economic growth.

By analyzing three distinct models using vital and demographic variables as dependents (life expectancy, infant mortality, and total fertility rate), the study evidences the influence of education. Specifically, it highlights the importance of gender inequality in education, as this variable proves significant in most cases, even when controlling for both female and male education. It is concluded that gender disparity in secondary education (measured by the secondary schooling ratio) has a relevant impact in explaining regional disparities, outweighing other variables included in the models (though not necessarily reflected in the tables, such as average schooling ratio and higher education ratio).

While empirical findings in the literature emphasize the greater effect of women's education on growth—not only through increased human capital, but also due to better child nutrition, improved prenatal care, greater knowledge of birth control, etc.—our results underscore that both female and male education are important for greater economic growth and development. The study shows that gender equality in education is a desirable goal for the Chilean economy and a driver of individual well-being across all regions. This equality is particularly important when evaluating indirect effects, as in most cases it proved more influential than the individual effect of male or female education alone.

Public policies should focus on reducing gender gaps in education to foster more inclusive and sustainable economic development. It

is crucial to implement educational programs that promote equal participation of women and men from an early age, as well as to ensure continuous access to higher education. It can be inferred that improving women's educational conditions not only impacts their own quality of life, but also affects future generations and society as a whole.

The study emphasizes the need for a gender perspective in the design of education and health policies, highlighting that investing in both female and male education yields significant returns in terms of economic and social well-being. Future studies will delve deeper into the evaluation of other mediating variables and consider the impact of educational policies on other aspects of social welfare.

6. Bibliography

- [1] Sen A. *Desarrollo y libertad*. 1.a ed. Barcelona: Planeta; 2000.
- [2] Mieres Brevis M, Rivas L. *Desigualdad en educación y crecimiento económico: Un enfoque por género en Chile*. Manuscrito inédito; 2024.
- [3] Knowles S, Lorgelly P, Owen PD. Are educational gender gaps a brake on economic development? Some cross-country empirical evidence. *Oxford Economic Papers*. 2002;54(1):118–49.
- [4] Lagerlöf NP. Gender inequality, fertility, and growth. Mimeographed. Department of Economics, University of Sydney; 1999.
- [5] Hill MA, King EM. Women's education and economic well-being. *Feminist Economics*. 1995;1(2):21–46.
- [6] Murthi M, Guio AC, Dreze J. Mortality, fertility, and gender bias in India: A district level analysis. *Population and Development Review*. 1995;21(4):745–82.
- [7] Summers LH. Investing in all the people: Educating women in developing countries. The World Bank; 1994.
- [8] Barro R, Lee JW. International comparisons of educational attainment. *Journal of Monetary Economics*. 1994;32(3):363–94.
- [9] King EM, Mason AD. Women's education in developing countries: An overview. The World Bank; 2001.
- [10] Klasen S. Low schooling for girls, slower growth for all? Cross-country evidence on the effect of gender inequality in education on economic development. *The World Bank Economic Review*. 1999;16(3):345–73.
- [11] Mieres Brevis M. Income Inequality in Latin America and Its Impact on Growth: The Particular Case of Chile. *Revista de Estudios Regionales*. 2025. En prensa.
- [12] Blackden M, Canagarajah S, Klasen S, Lawson D. Gender and growth in Sub-Saharan Africa: Issues and evidence. In: *Advancing Development*. Springer; 2007. p. 349–70.
- [13] Sen A, Brundtland G. World Health Organization. *Health in Development*. Geneva: WHO; 1999.

- [14] Abu-Ghaida D, Klasen S. The costs of missing the Millennium Development Goal on gender equity. *World Development*. 2004;32(7):1075–1107.
- [15] UNESCO. La educación de las niñas: Los datos. París: UNESCO; 2003 [citado 2019 abr 29]. Disponible en: <https://unesdoc.unesco.org>
- [16] Kim J, Jung J. The long-term impact of college education on women's attitudes toward marriage and children. *Journal of Family Issues*. 2023;45(1):103–23.
- [17] Collin M, Weil DN. The effect of increasing human capital investment on economic growth and poverty: A simulation exercise. *Journal of Human Capital*. 2020;14(1):43–83.
- [18] Goldin C. Career and family: Women's century-long journey toward equity. Princeton: Princeton University Press; 2021.
- [19] Canning D, Raja S, Yazbeck AS. Economic effects of the demographic dividend. In: *Reaping the Demographic Dividend*. Washington DC: World Bank; 2015. p. 129–68.
- [20] Bloom DE, Williamson JG. Demographic transitions and economic miracles in emerging Asia. *World Bank Economic Review*. 1998;12(3):419–56.
- [21] Klasen S, Lamanna F. The impact of gender inequality in education and employment on economic growth: New evidence for a panel of countries. *Feminist Economics*. 2009;15(3):91–132.
- [22] Bloom DE, Canning D, Sevilla J. The demographic dividend: A new perspective on the economic consequences of population change. Santa Monica: Rand Corporation; 2003.
- [23] Dao NT, Dávila J, Greulich A. The education gender gap and the demographic transition in developing countries. *Journal of Population Economics*. 2021;34:431–74.
- [24] Barro R, Lee JW. Education and growth. *Journal of Political Economy*. 1993;101(2):363–94.
- [25] Donoso R. Transición demográfica en Chile: Cambios y proyecciones. *Estudios Públicos*. 2007;(108):35–78.
- [26] Cerda R. Cambios demográficos y sus impactos en Chile. *Estudios Públicos*. 2008;(110):89–164.
- [27] Hill MA, King EM. Women's education in developing countries: Barriers, benefits, and policies. Baltimore: Johns Hopkins University Press; 1993.
- [28] Tena JD, Delgado M, Serna C. Gender, education and growth: Panel cointegration evidence for the OECD. *Applied Economics Letters*. 2009;16(10):1001–5.
- [29] Tansel A, Güngör ND. Gender effects of education on economic growth in Turkey. *Economics of Education Review*. 2016;54:147–58.

How the economics of happiness complements the understanding of the effects of economic growth on population well-being

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Abstract

The literature on happiness economics has significantly enhanced the understanding of population well-being. The quantitative view of well-being, measured through classical indicators, overlooks fundamental elements related to individuals' welfare. There is no doubt that economic growth is an important avenue for improving societal well-being; however, its effect on subjective well-being is not linear. Furthermore, empirical evidence shows that beyond a certain income level, an increase in income does not necessarily translate into higher subjective well-being for the population. In light of this—and especially following the so-called Stiglitz Commission empirical evidence emerging from the happiness economics literature has expanded the understanding of the complex process of human well-being. Accordingly, the objective of this chapter is to present the main findings from empirical work in this field and to demonstrate how these results can serve as a relevant input for the design and implementation of public policies aimed at increasing society's subjective well-being. Additionally, novel and specific evidence for the case of Chile at the regional level is provided, highlighting the importance of incorporating a subnational perspective in the analysis of subjective well-being.

Keywords: Subjective well-being, life satisfaction, economic growth.

1. Introduction

It is no mystery today that economic growth is a relatively recent phenomenon in human history. For many centuries and millennia, economic activity did not expand, but rather remained at levels that barely allowed the population to survive. This began to change with the arrival of capitalism, which, coupled with the Industrial Revolution, enabled a rapid increase in countries' capacity for growth (see Table 1).

As the data show, economic growth has not been the norm throughout human history. In fact, over 1.700 years (from year 0 to 1700), Gross Domestic Product (GDP) per capita remained virtually unchanged—that is, the meager GDP growth was barely enough to keep up with population growth.¹ However, during the era of mercantile capitalism, despite a significant increase in the population growth rate, GDP per capita began to grow rapidly. This was due to a more dynamic performance of overall production.

Table 1: History of economic growth around the world.

	Population growth	Growth of per cápita product
Agricultural economics (0-1500)	0.04	0.01
Advanced agricultural economics (1500-1700)	0.16	0.04
Merchant Capitalism (1700-1820)	0.46	0.07
Capitalism (1820-2000)	1.00	1.31

Source: Larraín, F, & Sachs, J. D. (2013).

Thus, driven by economic growth, a new era began characterized by prosperity and the distribution of wealth to a broader segment

¹ The growth rate of GDP per capita can be approximated as follows:

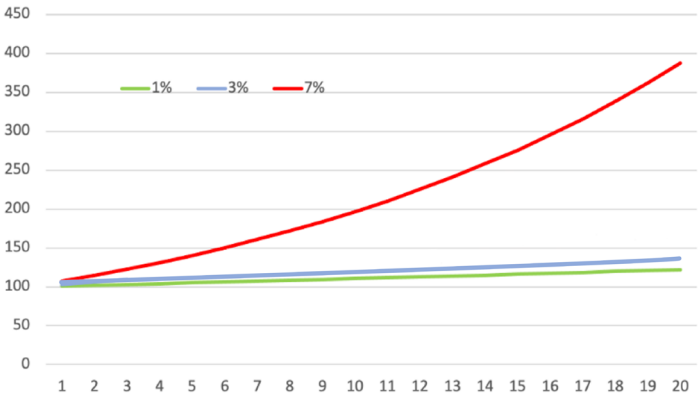
$$\Delta\%y \approx \Delta\%Y - \Delta\%N$$

Where y refers to GDP per capita, Y denotes total Gross Domestic Product (GDP), and N corresponds to the population size.

of the population. Today’s developed countries were certainly early beneficiaries of this process and, as a result, now display excellent indicators in terms of well-being. Indeed, economic growth, acting as a kind of compound interest on a country’s income, has a multiplicative effect over time, as illustrated in Figure 1.

The Figure clearly illustrates the results of growing at different rates over time. For example, if an economy grows at 1%, after 10 years its GDP will have increased by just over 10% from its original size (green line). In contrast, if the economy maintains an average growth rate of 3%, by the end of those 10 years, its GDP will have grown by around 35%. But both scenarios fall far short of what can be achieved with a sustained annual growth rate of 7%. Indeed, maintaining a growth rate of that magnitude allows the economy to double the size of its original GDP within 10 years. In this graphical exercise, this means that in year one the economy had a size of 100, but after 10 years, its size is 200. This represents, without a doubt, a qualitative change—not only in the scale of economic activity but also in income levels, which ultimately translates into a better average quality of life for the population. This concept is well summarized by the so-called “Rule of 70,” which states that if an economy grows at a rate of “X%,” it will take “70/X” years to double its GDP. From a macroeconomic perspective, 10 years is a relatively short period.

Figure 1: The Multiplicative Power of Growth.



Source: Own elaboration.

Unfortunately, the economic growth experienced by countries does not always translate into greater well-being for their populations. In fact, toward the end of the first decade of this century, significant social movements around the world revealed that economic growth was not benefiting everyone equally. French President Nicolas Sarkozy convened a commission of experts to better understand the complex process of social well-being, which is not always linearly enhanced by economic growth. This commission, known as the Stiglitz Commission, determined that there was considerable room for improvement in understanding the evolution of population well-being.

One of the commission's recommendations was that “both objective and subjective well-being measures provide relevant information about people's quality of life. National statistics offices should include survey questions that capture life evaluations, hedonic experiences, and individuals' priorities.” Indeed, it is difficult to assess human progress solely in terms of economic performance, as both material and non-material goods contribute to people's well-being. This means that higher GDP or income levels do not necessarily imply greater subjective well-being [1].

Since then, a rich research agenda has emerged under the umbrella of happiness economics, which investigates the main drivers of subjective well-being. While this field existed prior to the Stiglitz Commission, it gained momentum after the publication of that revealing report. Since then, renowned economists, including Nobel Prize winners, have contributed to the development of this research, helping to better identify the variables that trigger virtuous cycles of improvement in the population's subjective well-being.

Thus, the objective of this chapter is mainly to highlight the key findings from the happiness economics literature and how these findings can serve as valuable inputs for the design and implementation of public policies—ultimately enabling a significant increase in the population's levels of subjective well-being. To begin, the next section briefly summarizes the methodological approaches used in the empirical work within this literature.

2. Understanding Subjective Well-Being

Following the conclusions of the Stiglitz Commission, there has been a growing body of information related to the subjective well-being of populations. Today, various surveys are regularly conducted in different countries around the world, where, among other things, people are asked about their satisfaction across different dimensions of their lives. For example, regarding life satisfaction, the question usually posed is: *Taking all aspects of your life into account, on a scale from 1 to 10, where 1 is completely dissatisfied and 10 is completely satisfied, how satisfied are you with your life?*²

This question, which explores life satisfaction, seeks a subjective evaluation of long-term well-being—a sort of life balance from a structural perspective of the individual's lived experience. The responses are then systematized to carry out econometric analyses aimed at understanding which factors lead people to classify themselves as satisfied with their lives.

In addition, similar questions are asked regarding individual happiness, a concept that may be more momentary and transitory, related to short-term experiences. For this, the typical question is: *On a scale from 1 to 10, where 1 is completely unhappy and 10 is completely happy, where would you place yourself?*

Following this logic, similar questions can be extended to other areas of people's lives, with one particularly important dimension being work. For instance, a commonly included question is: *On a scale from 1 to 10, where 1 is completely dissatisfied and 10 is completely satisfied, how satisfied are you with your job?*

It is also common to find survey instruments with questions about satisfaction with family life, neighborhood, friendships, health, financial situation, among others. Thus, today's surveys—especially those conducted in developed countries—include a range of questions that gather information on individuals' subjective well-being.

There are two main approaches to studying the determinants of subjective well-being, whether it is measured through life satisfaction, happiness, or another variable. The first is known as the orthodox approach, in which the dependent variable representing subjective

well-being is directly modeled as a function of a set of observable characteristics relevant to well-being. Figure 1 schematically presents what the orthodox approach entails.

Figure 1: The Orthodox Approach.



Under this approach, the explanatory variables of the model can generally be classified into three categories: individual characteristics, environmental characteristics, and others. More formally, the model to be estimated is the following:

Equation 1:

$$y_i = x_i'\beta + z_i'\gamma + w_i'\delta + u_i$$

where y_i represents a measure of subjective well-being (life satisfaction, happiness, mental health, or another), x_i' is a vector containing variables related to individual characteristics, z_i' is a vector containing variables related to environmental characteristics, w_i' is a vector containing variables related to other relevant characteristics, u_i is a well-behaved stochastic shock, and β , γ , and δ are parameter vectors to be estimated.

Among individual characteristics, variables commonly included are the person's age, gender, level of education (e.g., measured by years of schooling), and income level.²

² It is essential to include all sources of income, not only those derived from the labor market.

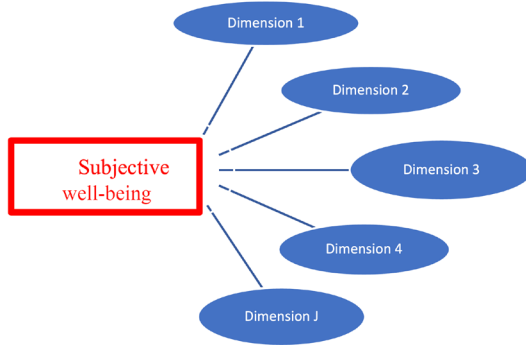
Regarding environmental characteristics in which individuals operate, commonly included variables relate to geographic location (region, municipality, state, county, urban or rural), housing conditions (number of rooms, overcrowding indicators, construction materials), and neighborhood conditions (availability of services such as proximity to public transportation, shopping centers, hospitals, schools, among others).

Finally, in the “other” category, variables related to recent phenomena studied in the literature are included. For example, it has been found that what matters to an individual is not only their absolute income but also their income relative to a reference group.³ To assess this, the reference group with which the individual compares themselves must be identified, and thus relative income can be constructed. This category may also include variables related to individual personality traits—although these are difficult to incorporate since they are unobservable (from the researcher’s standpoint), there is a wide body of literature attempting to build proxies for personality traits in order to avoid bias in estimators.

A second approach to studying the determinants of subjective well-being is known as the aggregation approach. Under this approach, it is assumed that an individual’s subjective well-being is a consequence of the satisfaction they achieve in different areas or domains of their life, such as satisfaction with family life, friends, housing, neighborhood, work, health, etc. In other words, an individual’s well-being is built from the satisfaction they attain in each of these life dimensions or domains [2].

Figure 2 schematically presents how individual subjective well-being is modeled in the context of the aggregation approach.

3 In general, the reference group is constructed exogenously. That is, certain variables are arbitrarily selected to define a comparison group. These variables typically include age, education level, gender, and geographic region of residence. Based on these variables, cells are constructed to classify individuals—for example, one cell might consist of men aged 30 to 39, with 13 to 17 years of schooling, living in an urban area. The average income of this subgroup is then calculated, and this figure represents the reference group income for the individual in question.

Figure 2: The aggregation approach.

Therefore, under the aggregation approach, subjective well-being is considered the result of the well-being an individual experiences across different dimensions of their life, assuming here that there are “ J ” relevant dimensions that explain it. More formally, the model estimated is the following:

Equation 2:

$$y_i = \sum_{j=1}^J \alpha_j d_{ij} + u_i$$

where, once again, y_i represents a measure of subjective well-being, d_j are the relevant domains, u_i is a well-behaved stochastic shock, and the α_j are the parameters to be estimated.

There is extensive literature regarding which dimensions determine individuals’ subjective well-being, and these do not necessarily coincide across different countries, cultures, or time periods. Generally, the dimensions identified as relevant include those related to work, health, housing, family, friends, and the neighborhood.

In this context, there is one particular dimension that draws significant attention from researchers: job satisfaction. This is not surprising, given that work represents a highly important dimension in people’s lives. Therefore, it is essential to understand the factors that lead to increased job satisfaction, which in turn contributes to increased labor productivity. Accordingly, there is ample empirical evidence on

the determinants of job satisfaction. This body of literature mainly follows the orthodox approach, in which job satisfaction is established as the dependent (or explained) variable, influenced by a set of characteristics, both individual and job-related.

There is one final aspect that must be carefully considered when conducting estimations aimed at explaining subjective well-being: personality traits. This variable is relevant in explaining individuals' satisfaction and, therefore, efforts should be made to include it in some way. In this context, it is worth noting that in the Happiness Economics literature, there are essentially two types of data used in empirical research: cross-sectional data and longitudinal (time-series) data.

Cross-sectional data are generally not optimal for incorporating variables related to individuals' personality traits. However, the methodology proposed by [2] can be applied, which allows for the construction of a proxy variable for personality traits. In this way, an explanatory variable is incorporated that accounts for all unobservable factors assumed to be fixed over time, cutting across the different life dimensions, thereby approximating a measure of individual personality traits.

On the other hand, there is longitudinal data, which is abundant in developed countries. This allows for panel estimations with fixed effects, enabling the consideration of unobservable factors when explaining individuals' subjective well-being.

Following this brief methodological explanation, the next section presents a review of the main elements that have emerged from empirical evidence as determinants of individuals' subjective well-being. It should be noted that, since developed countries have a longer history of collecting this type of data, the available empirical evidence is more abundant for them.

3. Review of Empirical Evidence

As previously mentioned, since the release of the Stiglitz Commission report, there has been significant debate regarding how subjective well-being can be incorporated into the regular measurements conducted by countries. Indeed, the report led by Joseph Stiglitz and Amartya

Sen provided recommendations on how countries could complement GDP measurements with subjective indicators. While progress in terms of public policy has been limited, the available empirical evidence has grown rapidly.

One of the main concerns arising from the happiness economics literature—particularly within the field of economics—relates to how reliable these measures are in practice, considering the role subjectivity plays in the analysis. In this context, the evidence presented by [3] is interesting, as it demonstrates a strong relationship between objective conditions of well-being and subjective well-being measures. Consequently, subjective well-being indicators can be trusted as robust measures of a population's overall well-being.

3.1. Orthodox Approach

Pioneering studies in the area of subjective well-being were conducted by Richard Easterlin, who analyzed the relationship between subjective well-being and monetary income. His most important finding, known as the “Easterlin Paradox,” revealed that there is no positive correlation between subjective well-being and income over time, although such a correlation exists in cross-sectional data [4-8]. [9] complemented the empirical evidence in this area, showing that while per capita income has increased in countries such as the United Kingdom, the United States, and Japan, average happiness has remained relatively constant. Nonetheless, when using cross-sectional data, evidence shows that the relationship between income and happiness is positive, significant, and concave—thus identifying a diminishing marginal utility of income with respect to happiness.

One explanation for why the positive relationship found in cross-sectional data disappears in time-series data is related to the phenomenon known as the aspiration gap. As individual income grows, so does the income of the reference group one aspires to match, and thus the aspiration gap does not close with income increases.⁴ What matters for explaining subjective well-being is not only absolute

4 The aspirational gap is defined as the disparity between an individual's actual income and their desired income level.

income, but also the aspiration gap. If that gap remains, there is no reason to expect an increase in subjective well-being as income rises.

Another explanation for the Easterlin Paradox is the adaptation phenomenon, where individuals adapt to their new income levels after an increase. [10] provide evidence of this adaptation process in Germany. Using German Socio-Economic Panel Data (GSOEP), the authors found a full adaptation to the new income level within four to five years. Interestingly, they also found that the degree of adaptation increases as income rises.

A third explanation lies in the fact that individuals care not only about their absolute income but also their relative income (which is also somewhat related to the aspiration gap). [11], using GSOEP data, shows that relative income is just as important as absolute income in explaining subjective well-being in Germany. [12] add an interesting dimension to this, showing that personality traits influence how relative income affects individuals.

Using U.S. data, [13] present evidence of how neighbors' income affects individual subjective well-being. They conducted analyses at county, ZIP code, and street levels, finding a negative relationship between neighbors' income and individual well-being at the county and street levels. However, this relationship is reversed at the ZIP code level. They argue that people prefer living in wealthy ZIP codes with little or no poverty because of preferences for high social status.

For Latin America, [14] analyzed the relevance of relative income using the 2007 Gallup survey. The author examined two measures of subjective well-being: life evaluation and economic satisfaction. Constructing the reference group's income based on age and gender, he found that relative income is crucial in explaining both life evaluation and economic satisfaction. In fact, 60% of the gains in life evaluation were due to increases in relative income, while only 40% were due to increases in absolute income.

On the other hand, [15] present evidence for Europe regarding the intensity and direction of income comparisons among individuals. Their results reveal that coworkers are the most common comparison group. The authors show that reference groups are endogenous—individuals are more likely to compare themselves with those they interact with frequently.

Clearly, as mentioned in the introduction (Figure 1), monetary income is only one of many factors affecting or determining people's well-being. [16] found that women, white individuals, married people, and those with high education levels generally report higher happiness. Conversely, unemployment and divorce negatively affect happiness. Moreover, [17] show that unemployment rates also negatively impact subjective well-being. Finally, [18] found that the relationship between subjective well-being and age follows a U-shape; in other words, high levels of well-being are achieved in both early and late stages of life.

As previously mentioned, a particularly relevant dimension of subjective well-being is related to work, and thus there is a broad literature exploring the determinants of job satisfaction. The modeling strategy used here follows the orthodox approach, and again, international empirical evidence is dominant.

Following [19], many articles have been published on the determinants of job satisfaction. For instance, reference group wages affect individual job satisfaction [20]. Evidence also shows that, on average, women are more satisfied with their jobs and prefer part-time work over full-time employment [21-22]. However, using data for Chile, [23] found that part-time work negatively affects job satisfaction due to its relative precariousness compared to full-time jobs, but that this effect is completely reversed for women. They interpret this result as showing that part-time work allows women to better reconcile work and family life, thus fulfilling the dual role prescribed by societal cultural norms [24-25].

There is also evidence regarding how income shocks affect the distribution of job satisfaction [26], and how peer wages—i.e., reference group income—affect it. From a theoretical perspective, there is a proposed negative relationship between relative income and individual job satisfaction, which is known as the “comparison effect” [20], [27-29].

However, other authors have proposed a different relationship between relative income and subjective well-being. [30], for example, argue that higher reference group income may increase job satisfaction because it provides valuable information about individual future prospects. That is, the better the future wage prospects (understood as the wage of the reference group), the greater the individual's job

satisfaction. This is known as the “information effect” [31]. In this regard, [20] show that UK workers’ well-being depends on their relative income, which is determined by their relevant reference group. [32] also provide evidence for the UK, showing that the effect of relative wage on job satisfaction differs between men and women.

For the United States, [27] estimate an asymmetric effect of reference wages. They show that when an individual’s wage is below the reference wage, job satisfaction decreases and job search activity increases. However, when the individual’s wage is above the reference group’s, there are no significant effects.

Finally, [33], using Chilean data, present evidence on the relationship between job satisfaction, individual wage, and reference group wage. Using a semi-nonparametric estimation of ordered probit models, they show that a 10% increase in the reference group wage would require a 24,9% increase in one’s own wage to maintain the same level of job satisfaction.

Analyzing the determinants of job satisfaction is also crucial for the overall economy, as empirical evidence shows that job satisfaction predicts turnover, absenteeism, and labor productivity—factors that may significantly influence employment levels and economic growth. In particular, understanding the link between job satisfaction and wage structure is key for human resource managers, as workers’ effort, and hence their productivity, may depend on the gap between wages perceived as “fair” and actual wages [34]. A fair wage can be understood as the average income of a worker’s reference group, which may be defined as individuals with a similar level of human capital.

More recently, particularly in the wake of the Covid-19 pandemic, a growing body of research has examined the relationship between working from home and subjective well-being. It is worth noting that the effect of remote work on well-being is theoretically ambiguous. On the one hand, well-being may improve due to reduced time and financial costs associated with commuting, greater flexibility, and a better work–life balance. On the other hand, well-being may deteriorate due to limited interaction with colleagues, lack of recognition, poor-quality interactions with direct supervisors, increased multitasking, and time fragmentation resulting from blurred boundaries between work and

family life—issues that may be especially significant for women with young children. Therefore, the net effect of this work modality on subjective well-being remains unclear [35-37].

In this context, [38], using UK data, found a positive effect of teleworking on life satisfaction among individuals in relationships without children. [39], in turn, identified various health-related effects associated with teleworking. The authors highlighted the complexity of the work–health relationship and emphasized the need to consider broader factors to account for telework’s impact on workers’ health. Along similar lines, [40] analyzed the evolution of feelings of loneliness in Germany. Their estimates indicated that both men and women experienced increased loneliness during the Covid-19 pandemic. Moreover, using data from Italy, [41] provided evidence of technostress among workers as a consequence of teleworking. [42] found that the increase in telework due to lockdowns in the UK was most acutely felt by higher-paid and more highly skilled workers, as well as by those living in London and the southeast. The authors showed that the shift to telework negatively affected individuals’ mental health; however, this effect diminished as workers adapted to the new working conditions. [43] tracked individuals’ well-being across five European countries throughout the course of the Covid-19 pandemic.⁵ They measured well-being across five dimensions: life satisfaction, perceived life meaningfulness, loneliness, depression, and anxiety. Their results showed that well-being was lower among those working from home and lowest among those not working at all. Notably, the loss of well-being due to working from home was more pronounced among older individuals, those with higher educational attainment, individuals with young children, and those living in more crowded housing.

The importance of family structure was also examined by [44]. Using data from the German Socio-Economic Panel (GSOEP), the authors demonstrated that working from home had a negative average effect on life satisfaction during the first two years of the Covid-19 pandemic. However, reduced life satisfaction was only observed among single men and women with school-aged children. Furthermore, the authors found that this negative effect disappeared by 2021, suggesting

5 The countries included were France, Italy, Germany, Spain, and Sweden.

adaptation to the newly imposed constraints. Lastly, [45], using data from Chile, assessed the relationship between working from home and life satisfaction, job satisfaction, and mental health problems. Their findings show that women working from home report greater life satisfaction, and both men and women report higher job satisfaction. On the other hand, they find a positive relationship between remote work and mental health problems in the case of men.

3.2. Aggregation Approach

As previously mentioned, the second strategy for empirically understanding the determinants of subjective well-being corresponds to the aggregation approach. In this regard, there is also abundant literature for both developed and developing countries. For example, in a study conducted by [46], which uses an aggregation approach to analyze the determinants of life satisfaction in Mexico, it was shown that satisfaction in personal, economic, health, work, and family domains were relevant predictors of life satisfaction. In a similar study using data from the United States, [47] observed that, on average, individuals' satisfaction with their finances, health, work, and family life were important for their overall life satisfaction.

On the other hand, using data from Germany, [2] identified the main domains that affect subjective well-being. The authors concluded that work, personal finances, housing, health, leisure, and the environment were areas whose satisfaction contributed significantly to overall satisfaction. [48] reached similar conclusions by analyzing data from the British Household Panel Survey (BHPS): satisfaction in the areas of work, finances, housing, health, amount and use of free time, marriage, and social life contribute to life satisfaction.

Thus, the evidence suggests that finances, health, and work are very important domains for life satisfaction. [49], using data from Canada, show that satisfaction in areas related to social, cultural, and land-use factors are the most relevant determinants of well-being. They also observed that these social, cultural, and land-use factors contribute to satisfaction in all other domains (education, employment, income, health, and housing).

There is also evidence for developing countries. [50] show that happiness in Bangladesh depends on different life domains and income. In fact, the authors find that income explains much of the variation in overall happiness and is closely related to domain-specific happiness, even in domains that are not economic. They conclude that financial and work satisfaction, as well as happiness in the domain of social life, are relevant to people's life satisfaction.

Additionally, using a sample of Latin American countries, [51] analyze dimensions of subjective well-being related to a wide range of domains, such as institutional and social circumstances, satisfaction with access to medical care and education, availability of green areas and public spaces, municipal services, roads and paving, public transport, garbage collection, sewage services, and the pension system. They also study satisfaction regarding democracy and the economy. The results of their analysis suggest that these dimensions also help explain happiness levels.

Finally, [52] provide evidence for Chile, identifying the domains that contribute to life satisfaction among the employed. Based on their results, they conclude that satisfaction in the areas of money, privacy, leisure, family life, health, and work positively affects life satisfaction. It is shown that satisfaction with family life, leisure, health, and work has a greater effect on life satisfaction than satisfaction with money and privacy.

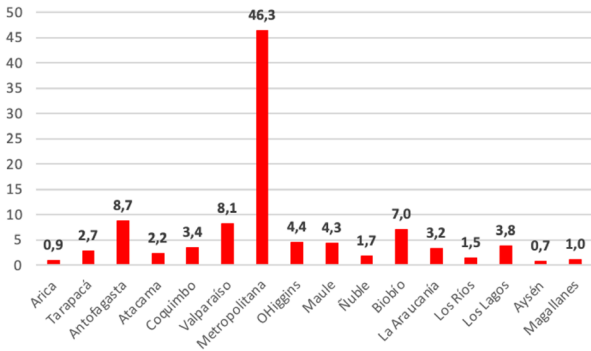
4. The Relevance of a Regional Perspective: Evidence from the Case of Chile

As is the case with various socioeconomic variables, the average well-being level for a country may offer limited insight into the heterogeneity of life experiences among the inhabitants of specific geographic areas. Therefore, it is essential to adopt a subnational perspective that accounts for the diverse realities existing within a given country. This approach enhances the availability of information and contributes to a more comprehensive understanding of the dynamics of subjective well-being—whether in terms of mental health, life satisfaction, happiness, or other dimensions. Accordingly, this section

places particular emphasis on examining subjective well-being in the specific case of Chile, with a focus on the internal variation across its geographic regions.⁶

Chile presents a unique case due to its distinctive geography: a long and narrow strip of land encompassing diverse realities and ecosystems. The country is divided into 16 regions, which differ significantly from one another. As an illustration, consider Figure 2, which shows the contribution of each region to the country’s total GDP.⁷

Figure 2: Regional GDP Contribution in Chile.



As can be observed, there is substantial variation in the contribution of each region to the national GDP. While the country’s capital (Region Metropolitana) accounts for 46,3% of GDP, the contribution of the Aysén Region amounts to just 0,7%. It is also noteworthy that following the Region Metropolitana is Antofagasta, though at a considerable distance, with 8,7%, closely followed by Valparaíso at 8,1%. Together, these three regions account for 63,1% of total national output—a highly significant figure. This concentration is important to highlight, as disparities in GDP levels ultimately translate into differences in income levels and, consequently (and potentially), into differences in indicators of subjective well-being.

6 Chile is composed of a total of 16 regions, which are as follows: Arica y Parinacota, Tarapacá, Antofagasta, Atacama, Coquimbo, Valparaíso, Metropolitana, O'Higgins, Maule, Ñuble, Biobío, La Araucanía, Los Ríos, Los Lagos, Aysén, and Magallanes.

7 The analysis was conducted using GDP data from the year 2023.

To illustrate this point, we estimate the annual income level that maximizes happiness for residents in each of the aforementioned regions.⁸ In a widely cited study, [53] conducted a similar exercise using data from the United States and found that the income level that maximizes happiness is approximately US\$80,000 per year. Moreover, they show that individuals earning US\$160,000 annually report nearly the same level of subjective well-being, indicating diminishing marginal utility of income with respect to well-being.

Similarly, [54], using Chilean data, estimate this threshold to be slightly above US\$60,000 per year. That is, beyond this income level, subjective well-being remains constant, confirming the decreasing marginal utility of income in relation to individuals' well-being. Within this context, it is worth asking whether there is regional heterogeneity in this threshold when the analysis is carried out at the subnational level.

To address this question, we extend the work of [54] by estimating the model parameters for each of the country's regions in order to identify the income level that maximizes life satisfaction.⁹ Figure 3 presents the results of this exercise.

As can be observed, there is considerable regional heterogeneity in the level of income that maximizes life satisfaction.¹⁰ As expected, the

8 The methodological strategy to identify the value that maximizes life satisfaction for a given data sample is as follows; first, an econometric model is estimated in the following form:

$$f_i = \beta_0 + \beta_1 y_i + \beta_2 y_i^2 + x_i' \beta + u_i$$

where f is a measure of individuals' subjective well-being (on a scale of, for example, 1 to F), y is the individual's income, x is a vector of characteristics that affect the individual's subjective well-being (controls), u is a well-behaved stochastic shock, and the β are parameters to be estimated. Then, the expected value of subjective well-being conditional on individual characteristics is given by:

$$E(f|y, x') = \beta_0 + \beta_1 y_i + \beta_2 y_i^2 + x_i' \beta$$

Finally, the income value (y^*) that maximizes expected subjective well-being is obtained by differentiating the expression with respect to " y " and setting the derivative equal to zero:

$$\frac{\partial E(f|y, x')}{\partial y} = y^* + 2\beta_2 y^* = 0$$

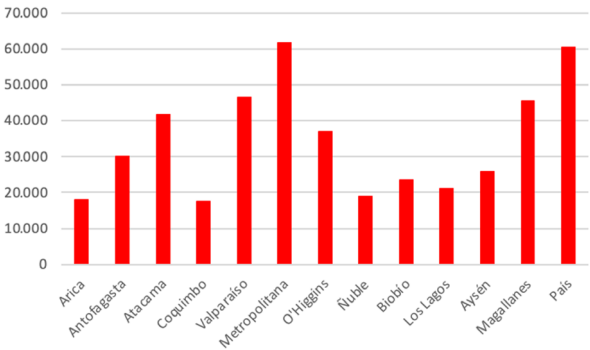
9 See footnote 8.

10 It should be noted that this econometric exercise could only be carried out for 13 of the 16 regions that make up the country. The reason for this is that in some regions, the low number of observations leads to a loss of efficiency, and the estimated coefficients become noisy.

Región Metropolitana requires the highest income level to maximize life satisfaction (US\$61.686 annually), followed by the regions of Valparaíso and Magallanes, with US\$46.352 and US\$45.556 annually, respectively.

On the other hand, the regions that require the lowest income levels to maximize life satisfaction include Coquimbo (US\$17.572), Arica (US\$17.885), and Ñuble (US\$18.849).

Figure 3: Income Level that Maximizes Life Satisfaction in Chile by Region.



When interpreting these figures, it is important to take into account certain factors, one of which relates to the differences in the cost of living across regions. Although the cost of living is a relevant determinant of the income level that maximizes life satisfaction, it cannot be incorporated into the current analysis due to the fact that Chile only provides a national-level consumer price index.¹¹ It should also be noted that other factors not included in the econometric model may also contribute to differences in the estimated income levels that maximize life satisfaction.

Therefore, the analysis carried out opens up interesting avenues for future research, which could shed further light on the determinants of subjective well-being at the subnational level and thus contribute to the design and implementation of more effective public policies.

¹¹ This task is carried out by the Instituto Nacional de Estadísticas de Chile; www.inec.gov.cl.

5. Reflections and Policy Implications

The following presents three reflections on the main findings from the literature on Happiness Economics, focusing primarily on how this evidence complements the understanding of the relationship between economic growth and people's subjective well-being.

The first aspect refers to the relative importance of monetary income as a determinant of individuals' subjective well-being. As expected, income has a positive effect on individual well-being; however, its impact diminishes as a person's income increases. From the perspective of economic growth, greater growth does not necessarily translate into increased well-being for the population; it is not an inexhaustible source of subjective well-being, but rather, there is a ceiling. This threshold has been estimated for some countries, and it is known that beyond a certain income level, additional income growth does not result in higher well-being [53].¹² Similarly, it is noted that individuals not only care about their absolute income, but also their relative income — that is, their salary or monetary income compared to that of their reference group, the group they identify with. In general, the evidence points to a negative effect of relative income on subjective well-being, as the comparison effect tends to dominate. This result is relevant for understanding income distribution within an economy. It reflects that higher levels of inequality tend to negatively impact subjective well-being, as such inequality does not necessarily imply future income gains for individuals (as proposed by the so-called “information effect” logic). Nonetheless, important challenges remain in understanding the mechanisms by which individuals construct their reference groups — that is, the group against which they compare themselves. Some evidence exists for developed countries, but for developing countries, this evidence is still scarce or even non-existent [15].

A second reflection relates to recognizing that subjective well-being is a complex and multifactorial phenomenon. Therefore, there is a significant challenge in continuing to generate evidence (especially

¹² As previously mentioned, [53] place this threshold at US\$80,000 per year for the United States. In contrast, [54] estimate this threshold to be slightly above US\$60,000 per year in the case of Chile.

for developing countries) that can enrich our understanding of this complex phenomenon. For example, as highlighted in the previous point, people care deeply about how they are positioned relatively within society. While individual and family variables, such as age, education, gender, and working conditions, affect subjective well-being, individuals also conduct analyses and comparisons when evaluating their overall subjective well-being. Thus, not only personal variables play a role, but also those of others and, importantly, the way this information is perceived and processed [12]. This brings to light the fundamental role played by unobservable elements in studying the determinants of subjective well-being. Personality traits are a key factor in the subjective evaluations people make about their life trajectories. Therefore, understanding these variables well also represents a challenge for the literature and is crucial to include in empirical analysis [2].

The third reflection concerns the public policy implications of the findings from Happiness Economics. Once the main drivers of subjective well-being are understood, the next step is to propose concrete measures for policymakers to strengthen it. In this context, three tentative recommendations can be made.

The first recommendation is to reinforce the message from the Stiglitz Commission regarding the need for national statistics institutions to make a particular effort to collect qualitative information about people's well-being [1]. In this way, the evolution of subjective well-being can be monitored, and it is possible to anticipate potential dissatisfaction that could trigger larger problems, for example, due to a mismatch between the progress shown by quantitative and qualitative well-being indicators.

The second recommendation is that economic growth should never be neglected. While it is true that it is not an inexhaustible source of society's subjective prosperity, the evidence clearly indicates a relationship between monetary income and subjective well-being. Therefore, economic growth, as a means of strengthening individual incomes, should always be on the public agenda. That said, it must not be forgotten that its effect diminishes — that is, once a certain threshold is crossed, its contribution to subjective well-being rapidly declines [53]. For this reason, other areas that also contribute to individuals' well-being

— and which have been highlighted by empirical evidence — should not be neglected. In fact, studies indicate the importance people place on family life, friends, their neighborhood, and surroundings. Therefore, a major public policy challenge lies in the need to create adequate infrastructure that enables people and their significant environments to interact and thrive in the best possible way, allowing them to enjoy so-called “relational goods,” which will help improve societal levels of subjective well-being. Ultimately, access to these resources will once again depend on the economy’s capacity for growth.

Finally, a third recommendation arises particularly from the relevance of the labor market in people’s lives. Comparative evidence shows that the work domain is a key determinant of individuals’ subjective well-being. That is, what happens in the labor market in terms of job satisfaction translates into different well-being levels for the population. The literature clearly identifies the factors that drive job satisfaction. Here, factors such as labor flexibility — represented by part-time work or remote work — stand out. Also important is wage equity, meaning that companies should implement pay policies that are equitable both horizontally and vertically within the organization.

And of course, employment formality is also a vital factor. Elements related to social protection and the existence of formal and stable long-term contractual relationships also enhance workers’ well-being, and consequently, their overall life satisfaction. It should also be noted that all these elements contribute to increasing individuals’ labor productivity.

6. Bibliography

- [1] Stiglitz, J. E., Sen, A., & Fitoussi, J. P. (2009). Report by the commission on the measurement of economic performance and social progress.
- [2] Van Praag, B. M., Frijters, P., & Ferrer-i-Carbonell, A. (2003). The anatomy of subjective well-being. *Journal of economic behavior & organization*, 51(1), 29-49.
- [3] Oswald, A. & S. Wu (2010). Objective confirmation of subjective measures of human well-being: Evidence from the USA. *Science*, 327, 576-79.
- [4] Easterlin, R. (1973). Does money buy happiness? *The Public Interest*, Vol. 30, pp. 3-10.

- [5] Easterlin, R., P. David & M. Reder (1974). Does economic growth improve the human lot? Some empirical evidence. Nations and Households in Economic Growth, Academic Press.
- [6] Easterlin, R. (2001). Income and happiness: towards a unified theory. The Economic Journal, Vol. 111, No. 473, pp. 465-84.
- [7] Easterlin, R. & O. Sawangfa (2009). Happiness, growth and the life cycle. Oxford University Press.
- [8] Easterlin, R., L. McVey, M. Switek, O. Sawangfa & J. Smith (2010). The happiness-income paradox revisited. Proceedings of the National Academy of Sciences.
- [9] Frey, B. S., & Stutzer, A. (2000). Happiness, economy and institutions. The economic journal, 110(466), 918-938.
- [10] Di Tella, R., J. Haisken & R. McCulloch (2007). Happiness adaptation to income and to status in an individual panel. NBER working paper No. 13159.
- [11] Ferrer-i-Carbonell, A. (2005). Income and well-being: An empirical analysis of the comparison income effect. Journal of Public Economics, Vol. 89, pp. 997-1019.
- [12] Budria, S., & Ferrer-i-Carbonell, A. (2019). Life satisfaction, income comparisons and individual traits. Review of Income and Wealth, 65(2), 337-357.
- [13] Brodeur, A., & Flèche, S. (2012). Where the streets have a name: Income comparisons in the US. Available at SSRN 2149727.
- [14] Rojas, M. (2012) Relative income and well-being in Latin America. Documento de trabajo Facultad Latinoamericana de Ciencias Sociales y Universidad Popular Autónoma del Estado de Puebla.
- [15] Clark, A. E., & Senik, C. (2010). Who compares to whom? The anatomy of income comparisons in Europe. The Economic Journal, 120(544), 573-594.
- [16] Blanchflower, D. G., & Oswald, A. J. (2011). International happiness: A new view on the measure of performance. Academy of Management Perspectives, 25(1), 6-22.
- [17] Di Tella, R., R. MacCulloch & A. Oswald (2001). Preferences over inflation and unemployment: evidence from survey of happiness. American Economic Review, Vol. 91, No. 1, pp. 335-41.
- [18] Blanchflower, D. G., & Oswald, A. J. (2008). Is well-being U-shaped over the life cycle? Social science & medicine, 66(8), 1733-1749.
- [19] Freeman, R. (1978) Job satisfaction as an economic variable. The American Economic Review. Vol. 68 No 2.
- [20] Clark, A. & A. Oswald (1996). Satisfaction and comparison income. Journal of Public Economics, Vol. 61, pp. 359-381.
- [21] Booth, A. & Van Ours, J. (2008) Job satisfaction and family happiness: the part-time work puzzle, The Economic Journal 118, 77-99.
- [22] Clark, A. (1997) Job satisfaction and gender. Why are women so happy at work? Labour Economics 4(4), 341-372.
- [23] Montero, R., & Rau, T. (2015). Part-time work, job satisfaction and well-being: Evidence from a developing OECD country. The Journal of Development Studies, 51(4), 370-385.
- [24] Alesina, A., Giuliano, P., & Nunn, N. (2013). On the origins of gender roles: Women and the plough. The quarterly journal of economics, 128(2), 469-530.

- [25] Asadullah, M. N., & Fernandez, R. M. (2008). Work-life balance practices and the gender gap in job satisfaction in the UK: Evidence from matched employer-employee data (No. 3582). IZA Discussion Papers.
- [26] Hamermesh, D. (2001) The changing distribution of job satisfaction. *Journal of Human Resources* 36(1), 1–30.
- [27] Card, D., A. Mas, E. Moretti & E. Saez. (2012) Inequality at work: the effect of peer salaries on job satisfaction. *The American Economic Review*, 102(6), 2981–3003.
- [28] Montero, R., & Rau, T. (2016). Relative income and job satisfaction in Chile. *Handbook of happiness research in Latin America*, 205–217.
- [29] Mumford, K., & Smith, P. N. (2012). Peer salaries and employee satisfaction in the workplace.
- [30] Clark, A. E., Kristensen, N., & Westergård-Nielsen, N. (2009). Job satisfaction and co-worker wages: Status or signal? *The Economic Journal*, 119(536), 430–447.
- [31] Manski, C. (2000) Economic analysis of social interactions. *Journal of Economic Perspectives*, vol. 14, pp. 115–136.
- [32] Mumford, K., & Smith, P. N. (2015). Peer salaries and gender differences in job satisfaction in the workplace. *The Manchester School*, 83(3), 307–313.
- [33] Montero, R., & Vásquez, D. (2015). Job satisfaction and reference wages: evidence for a developing country. *Journal of Happiness Studies*, 16, 1493–1507.
- [34] Akerlof, G. & J. Yellen. (1990) The fair wage-effort hypothesis and unemployment. *The Quarterly Journal of Economics*, vol. 105, No 2.
- [35] Henke, R. M., Benevent, R., Schulte, P., Rinehart, C., Crighton, K. A., & Corcoran, M. (2016). The effects of telecommuting intensity on employee health. *American Journal of Health Promotion*, 30(8), 604–612.
- [36] Lu, Z. & Zhuang, W. (2023). Can teleworking improve workers' job satisfaction? Exploring the roles of gender and emotional well-being. *Applied Research in Quality of Life*, 1–19.
- [37] Powell, A., & Craig, L. (2015). Gender differences in working at home and time use patterns: Evidence from Australia. *Work, Employment and Society*, 29(4), 571–589.
- [38] Gueguen, G., & Senik, C. (2023). Adopting telework: The causal impact of working from home on subjective well-being. *British Journal of Industrial Relations*, 61(4), 832–868.
- [39] Oakman, J., Kinsman, N., Stuckey, R., Graham, M., & Weale, V. (2020). A rapid review of mental and physical health effects of working at home: How do we optimise health? *BMC Public Health*, 20(1), 1–13.
- [40] Lepinteur, A., Clark, A. E., Ferrer-i-Carbonell, A., Piper, A., Schröder, C., & D'Ambrosio, C. (2022). Gender, loneliness and happiness during COVID-19. *Journal of Behavioral and Experimental Economics*, 101, 101952.
- [41] Molino, M., Ingusci, E., Signore, F., Manuti, A., Giancaspro, M. L., Russo, V., ... & Cortese, C. G. (2020). Wellbeing costs of technology use during Covid-19 remote working: An investigation using the Italian translation of the technostress creators scale. *Sustainability*, 12(15), 5911.

- [42] Reuschke, D., & Felstead, A. (2020). Homeworking in the UK: before and during the 2020 lockdown. WISERD Report, Cardiff: Wales Institute of Social and Economic Research.
- [43] Schifano, S., Clark, A. E., Greiff, S., Vögele, C., & d'Ambrosio, C. (2021). Well-being and working from home during COVID-19. *Information Technology & People* (ahead-of-print).
- [44] Senik, C., Clark, A. E., d'Ambrosio, C., Lepinteur, A., & Schröder, C. (2024). Teleworking and life satisfaction during COVID-19: the importance of family structure. *Journal of Population Economics*, 37(1), 1-24.
- [45] Montero, R., & Bernal, N. (2024). Gender and Well-Being Disparities Among People who Work from Home in Chile. *Journal of Happiness Studies*, 25(6), 71.
- [46] Rojas, M. (2006). Life satisfaction and satisfaction in domains of life: Is it a simple relationship? *Journal of happiness studies*, 7, 467-497.
- [47] Easterlin, R. A., & Sawangfa, O. (2007). Happiness and domain satisfaction: Theory and evidence.
- [48] Ferrer-i-Carbonell, A. & B. van Praag (2008). *Happiness Quantified: a Satisfaction Calculus Approach*, Nueva York, Oxford University Press.
- [49] Kant, S., Vertinsky, I., Zheng, B., & Smith, P. M. (2014). Multi-domain subjective wellbeing of two Canadian First Nations communities. *World Development*, 64, 140-157.
- [50] Mahmud, M., & Sawada, Y. (2018). Happiness in life domains: evidence from rural Bangladesh. *Economic and social development of Bangladesh: miracle and challenges*, 233-250.
- [51] Ateca, V., García-Muñoz, T., & Moro Egidio, A. I. (2016). Individual and social dimensions of subjective well-being: evidence across Latin-American Countries. *Handbook of Happiness Research in Latin America*, 357-388.
- [52] Montero, R., & Miranda, A. (2020). The determinants of life satisfaction among Chilean workers. *CEPAL Review*, August, N° 131.
- [53] Kahneman, D. & A. Deaton (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, vol. 107, N° 38, septiembre.
- [54] Montero, R., & Vásquez, D. (2024). Does the decision to participate in the labour market affect people's subjective well-being? Thank you for your interest in this ECLAC publication, 149.

Impact of Cultural Factors on Entrepreneurship. Evidence from a cross-country analysis and Singularity of Japan

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Abstract

Since the 1990s there is an extensive literature about main factors impacting on Entrepreneurship activity, and therefore on the genesis and development of Entrepreneurship Ecosystems. Research activity on these topics has been reinforced on last years after economic downturn of 2008-2013, especially in Europe, the US and Eastern Asian countries. From the author own experience dealing with entrepreneurs along some of the main worldwide start-up's hot spots, there is clear evidence about the key impact of some context factors on Entrepreneurship activity. Results from this research suggest that cultural factors are of the most interest to understand differences on Entrepreneurship among countries, since these factors are specific from every community and may become indeed important boosters or brakes of Entrepreneurship activity. It has been written a lot about these cultural factors, especially at reaching conclusions from specific cases, [5, 37]. However, it has been further less published on a cross-country basis, with few exceptions, [25, 47], even less using a qualitative comparative approach (fsQCA). Precisely, this work aims to fill this gap, making special attention to the case of Japan.

Keywords: Cultural factors, Entrepreneurship, Fuzzy set Qualitative Comparative Analysis (fsQCA), Global Entrepreneurship Monitor (GEM), Japan.

1. Introduction

Concerning Cultural, Social, Institutional and Economic factors which could have some impact on Entrepreneurship performance of countries, a great deal of works has been issued in the last years, and at least two main research lines might be found: on one hand, that related to the Impact of Socio-Cultural and Institutional factors, widely developed since the seminal work of Hofstede. Moreover, on the other hand, that concerned to the impact of Economic factors on Entrepreneurship, those which can be parameterized and quantified, most of the times carrying out regression analysis [15].

These latter works pursue very often to formalize impact of those factors on Entrepreneurship at a country level, contrasting hypothesis with empirical evidence from cases well documented of Israel, USA and UK, progressively enhancing the list in the last years to other countries [7], especially China. Concerning this latter case, which apparently constitutes an odd phenomenon of explosion of Entrepreneurship in a country which is officially a communist state, it has attracted attention of scholars at least in the last 30 years, in a similar way to the attention dedicated some years before to Japan. This country, on the other hand, shows a singularity that consists of presenting poor Entrepreneurship performance indicators together with high Innovation and Technology metrics [28].

Considered above framework, overall objective of this paper has been adopting the existing research line about Socio-Cultural and Institutional factors impacting on Entrepreneurship, identifying which they are (indeed our Research Question), with two methodological contributions as regards to recent publishing:

- Firstly, to incorporate historical analysis of countries to better understand their current situation.
- Secondly, to use as methodological framework and tool a Qualitative Comparative Analysis through Fuzzy Sets (fsQCA), instead of the popular regression's analysis. FsQCA approach has the great advantage of being able to use smaller data sets without losing significantly of results, avoiding some as well of the most common problems associated to regression's analysis, such as auto-regressivity and multi-collinearity.

2. Theoretical Framework

Concerning the first contribution of incorporating historical analysis, it leads in a natural way to introduce the question of the impact of Culture on entrepreneurship attitudes, since there is empiric evidence that countries' specific History lets setting diverse sets of social values [13, 28, 33]. Therefore, it is reasonable looking to own History of countries as a source to comprehend their current Culture, understood it as a "set of beliefs, values, and preferences capable of affecting behaviors, that are socially (not genetically) transmitted, and that are shared by some subset of society" [49]. It should be also considered that "only those countries with specific cultural tendencies will engender a strong entrepreneurial intention, hence more entrepreneurship and global competitiveness" [40].

According to the above exposition, research question of this work has been deployed through the discussion of the four following hypotheses, which have been contrasted using fuzzy set Qualitative Comparative analysis, fsQCA, coherently to a formal scientific hypothetico-deductive procedure.

- Hypothesis 1: Current Perceived Opportunities (PO) by potential entrepreneurs are dependent on the conjunction of 6-D (Six-Dimensions) Hofstede Factors.
- Hypothesis 2: Furthermore, Current PO by potential entrepreneurs can be explained at the end both by specific historic events of their countries and their national Culture as a whole.
- Hypothesis 3: Just several combinations of Hofstede Factors result necessary for the arisen of PO among potential entrepreneurs.
- Hypothesis 4: Moreover, just a few Hofstede factors result in sufficient conditions for the existence of PO, forming themselves part of a Magic Recipe for Entrepreneurship.

To contrast above hypotheses, it has been developed the research model shown on Figure 1. The model puts into relationship countries' national History framework both with Hofstede Six Dimensions variables (6-D) and with GEM indicators. Suitability to use Hofstede 6-D in this context is supported, among others, by Hofstede and

Hampden-Turner and Trompenaars. Moreover, it also justified the GEM framework in this context based on previous works, such as those by [5].

For this work purposes, Hofstede 6-D factors constitute the inputs or conditions of our research model, while indicators from GEM model will be the outputs: specifically, the already cited PO.

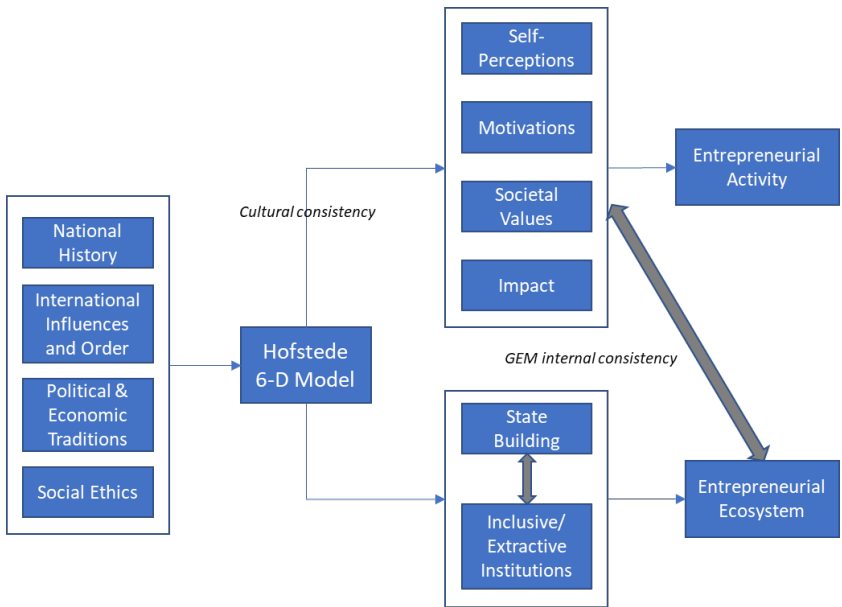
It should be also considered that along this research we intentionally do not enter into neither internal consistencies of Hofstede Model nor of GEM Model, but into understanding to what extent the Hofstede Six Dimensions factors (6-D) impact or not on GEM indicator of Perceived Opportunities, regarding to socio-cultural, regulatory, and institutional context of countries.

3. Materials and Methods

The data used in this study comes from lagged responses to business confidence surveys conducted in the Araucanía region by the Universidad Autónoma de Chile in the city of Temuco. These include perceptions regarding future sales, future prices, current national demand, and future investment. The surveys are conducted monthly, covering the period from September 2017 to March 2024. For the analysis, the employment rate reported by the Instituto Nacional de Estadísticas (INE) of Araucanía, recorded in rolling quarters over the same period, was used.

Initially, Autoregressive Distributed Lag Models (ARDL) were considered due to their ability to determine optimal lags and handle time series with different levels of integration. According to Pesaran and Shin (1999), ARDL models are effective for analyzing dynamic relationships between variables with different orders of integration. However, the initial results (Table 1) showed that most of the parameters were not significant despite having a high R^2 . This indicated potential endogeneity issues, leading to the exploration of more robust methods.

Figure 1: Research model developed.



Source: Author's own research

4. Methodology

4.1. ARDL Model Results

The next step was to apply Ordinary Least Squares (OLS) and Instrumental Variables (IV) models corrected for heteroskedasticity and autocorrelation. The OLS model was used as an initial approach to estimate the regression coefficients by minimizing the sum of squared errors. The OLS methodology served as a starting point to obtain a preliminary estimation of the relationships among variables, following Wooldridge's (2010) recommendations on correcting heteroskedasticity using robust standard errors.

To address potential endogeneity issues, the IV model was applied using the Two-Stage Least Squares (2SLS) method, employing instrumental variables such as the level of confidence regarding past

sales performance and past business conditions. According to Angrist and Pischke (2009), this method is suitable for correcting endogeneity bias by using instruments that are correlated with the endogenous variables but not with the model's error term. These instrumental variables are considered exogenous and help correct potential biases in estimates caused by the presence of endogeneity when incorporating lagged employment rate as an explanatory variable.

The IV-GMM approach was selected due to its capacity to address endogeneity problems and provide more consistent estimations (Hansen, 1982). Lagged variables were generated for relevant business perceptions (future sales, future investment, service prices, national demand, and future employment) using different lags as deemed necessary. Then, all time series were aligned by eliminating initial missing values to ensure data consistency.

To check for and eliminate potential multicollinearity issues, the Variance Inflation Factor (VIF) was used, removing variables with VIF values higher than 7. Subsequently, the IV-GMM model was applied, using additional instruments to strengthen model identification and correct for heteroskedasticity and autocorrelation in the residuals. Instrument validity was assessed using the Hansen J test.

The IV-GMM model adjustment process included incorporating autocorrelation terms to address possible issues in the model's residuals. This was done by fitting an autoregressive (AR) model to the residuals of the original model and then including the autocorrelation terms in the IV-GMM model. This procedure allowed for correction of residual autocorrelation, providing more accurate and reliable estimates. Based on this, the adjusted model was defined as follows:

Figure 2: Proposed IV-GMM Model.

America	Europe	Rest of World
Brazil	Austria	China
Canada	Finland	Egypt
Chile	France	India
Colombia	Germany	Japan
Mexico	Greece	Morocco
Panama	Ireland	Qatar
Puerto Rico	Italy	Saudi Arabia

America	Europe	Rest of World
United States	Luxembourg	South Africa
	Netherland	South Korea
	Norway	Turkey
	Spain	United Arab Emirates
	Sweden	
	Switzerland	
	United Kindogdom	

Source: Author’s own research

Data collection

For this work, quantitative data of 6-D factors have been taken from own Geert Hofstede website: <https://geerthofstede.com/culture-geert-hofstede-gert-jan-hofstede/6d-model-of-national-culture/> (last visit on Nov. 1st 2024), in which is explained the 6-D model of a national culture as a one “with six basic issues that society needs to come to term with in order to organize itself. These are called dimensions of culture and each of them is expressed on a scale that runs roughly from 0 to 100”.

According therefore to Hofstede (1984 and 2021), definition of each factor or dimension is showed on next table of Figure 3:

Figure 3: Variables Outcome and Conditions of fsQCA.

Outcome/ Conditions	Variables	Description	Source and Year
PO_(Outco- me)	Perceive Opportunities	Percentage of the 18-64 population who see good opportunities to start a firm in the area where they live.	Global Entrepre- neurship Monitor (GEM, 2022- 2023)
PD_	Power Distance 6-D Hofstede	The extent to which the less powerful members of organizations and institu- tions (like the family) ac- cept and expect that power is distributed unequally.	The 6-D model of national cultu- re (Hofstede, 1984,2021)

Outcome/ Conditions	Variables	Description	Source and Year
IND_	Individualism 6-D Hofstede	The degree of interdependence a society maintains among its members. It has to do with whether people's self-image is defined in terms of "I" or "We".	The 6-D model of national culture (Hofstede, 1984,2021)
MAS_	Masculinity 6-D Hofstede	A high score (Masculine) on this dimension indicates that the society will be driven by competition, achievement and success with success being defined by the winner / best in field – a value system that starts in school and continues throughout organizational life.	The 6-D model of national culture (Hofstede, 1984,2021)
UNCER_	Uncertainty Avoidance 6-D Hofstede	Deals with a society's tolerance for uncertainty and ambiguity.	The 6-D model of national culture (Hofstede, 1984,2021)
LTO_	Long term orientation 6-D Hofstede	This dimension describes how every society must maintain some links with its own past while dealing with the challenges of the present and future, and societies prioritize these two existential goals differently.	The 6-D model of national culture (Hofstede, 1984,2021)
INDUL_	Indulgence 6-D Hofstede	It is about the good things in life. This dimension is defined as the extent to which people try to control their desires and impulses, based on the way they were raised. Relatively weak control is called "Indulgence" and relatively strong control is called "Restraint.	The 6-D model of national culture (Hofstede, 1984,2021)

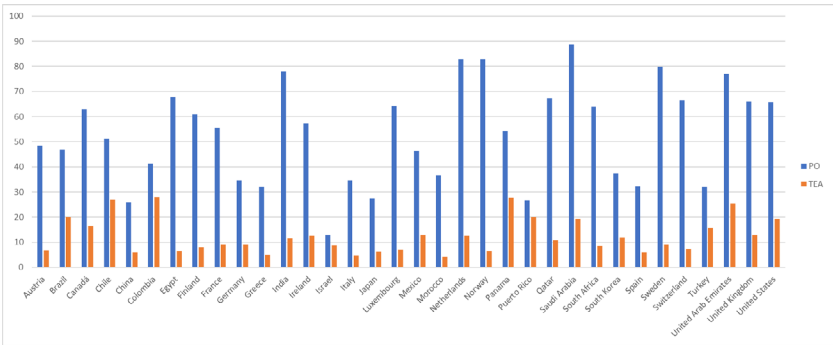
Source: Author's own research based on [7]

Furthermore, concerning data used from the GEM model, they are obtained from report 2022. Additionally, it should be considered that

GEM Model is a powerful tool with a wide set of data about features of entrepreneur attitudes and ecosystems, which gives data and metrics on the following six areas, getting info from experts from every country: Self- perceptions of entrepreneurs, Activity of entrepreneurship, Motivations, Impact, Societal values, and Ecosystem. Based on the findings of the Report, it is possible to acquire relevant insights, which show that a variety of stakeholders plays a critical role in facilitating the creation of enabling entrepreneurial ecosystems – including among them Policymakers, Private Sector, Educators and Researchers. Therefore, a Quadruple Helix [7] of stakeholders at National level (Academia, Business Sector, Government and Civil Society) plays an essential role. In this sense, recommendations for them highlight the ways in which educational institutions can equip individuals with the skill-sets to make use of entrepreneurial opportunities, as well as it remarks the importance of efficient IT infrastructures in reducing the cost of business, increasing market reach, improving access to information and allowing for innovation.

Data used from both sources are shown on next Figures 4 to 7.

Figure 4: Data of Perceived Opportunities and TEA rates in countries of sample.

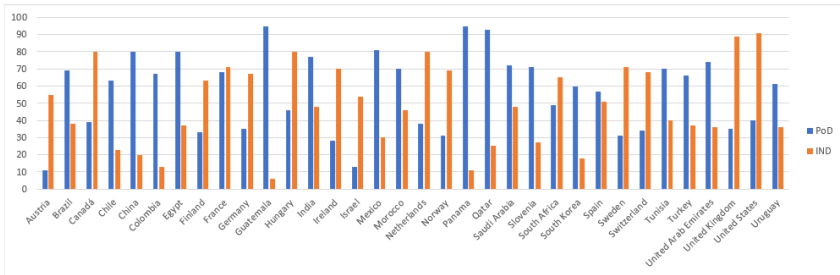


Source: Author's own research based on [7]

Based on above Figure 4, they are showed some evidence that could seem paradoxical. More in detail, it is seen that there's a peer group of countries which recurrently lead most of the above Entrepreneurship performance indicators (i.e. US, Israel, and the Netherlands); moreover, China has become an emerging star, with a quite good performance

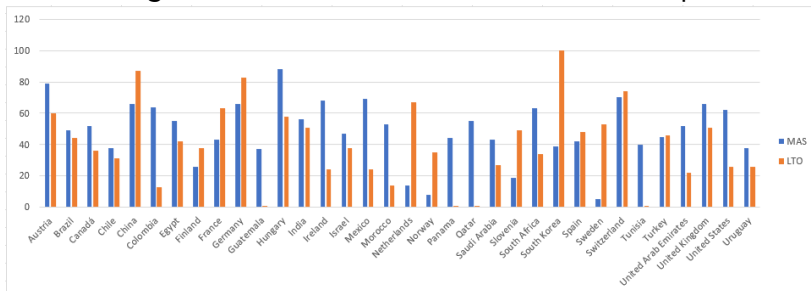
in most of the indicators. However, it is not easy to understand figures for Japan, significantly low regarding its high position on innovation benchmarks as a whole (specially in innovation in Robotics), unless some non-explicit factors were taken into consideration. Furthermore, we may wonder about which factors might be behind such a low rate in Japan regarding Self-Perceptions and Societal Values towards Entrepreneurship, or what is different in Japan with regards to other countries, which impacts so dramatically on these indicators, pointing out a singular path on Entrepreneurship and consequently leading to a very different entrepreneurial ecosystem. An attempt to answer to above questions is developed on next epigraphs of this paper, which explain why some Entrepreneurship metrics for Japan show such low values, proposing answers related to cultural, societal, and institutional factors.

Figure 5: Data of Power of Distance and Individualism in countries of sample.



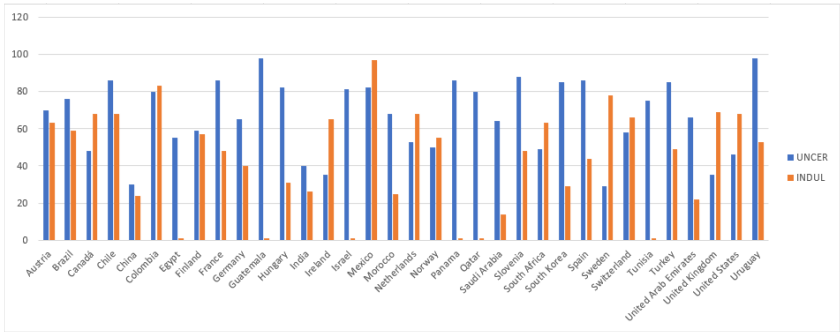
Source: Author's own research based on Figure 3.

Figure 6: Data of Masculinity and Long-Term Orientation in countries of sample.



Source: Author's own research based on Figure 3.

Figure 7: Data of Uncertainty Avoidance and Indulgence in countries of sample.



Source: Author's own research based on Figure 3.

4.2. Calibration

Table of Figure 8 shows main descriptive statistics and cut-off points for the calibration of conditions and outcome. Method used has been direct calibration [51], using the software R package developed by Medzihorsky [46]. Both conditions and outcomes values are expressed regarding to 100, so they could be all calibrated based on same general criteria of fuzzy score, that is, to establish three points of observation and related thresholds in the software:

- 0.05: non-membership to the set
- 0.5: neither in nor out, maximum ambiguity
- 0.95: complete membership

Figure 8: Calibration values and thresholds.

Condition/Outcome	Fully in	Cross over point	Fully out	Max	Min	Mean
PoD	0.95	0.5235294	0.05	95	11	56.8
Indiv	0.95	0.5020588	0.05	91	6	48.9
Masc	0.95	0.5173529	0.05	88	5	48.9
Uncer	0.95	0.5320588	0.05	98	29	66.9
LTO	0.95	0.4602941	0.05	100	1	40.2
Indul	0.95	0.4952941	0.05	97	1	43.7
PO (Outcome)	0.95	0.5194118	0.05	88.7	12.9	55.0

Source: Author's own research

4.3. Fuzzy set Qualitative Comparative Analysis (fsQCA)

In this work, fuzzy-set qualitative comparative analysis (fsQCA) is used to identify recipes or pathways that are necessary or sufficient for an outcome to occur. In this case, the outcome is the GEM indicator of Perceived Opportunities by potential entrepreneurs.

Important features of this type of analysis are its Equifinality, the same result can be obtained through multiple paths, and its Multi-Causality, [51], there could be multiple causes for a single phenomenon, which at the end means that a condition is sufficient if it explains the outcome by itself. In other words, the presence of a sufficient condition is enough to cause the outcome pursued, different combinations of conditions can lead to the same outcome and, depending on the context, a specific outcome can be the result of present and absent conditions.

Moreover, a condition is necessary if this condition is present whenever the outcome occurs. Given that few real-life phenomena are explained by a single condition, most solutions consist of combinations of conditions. In this sense, fsQCA identifies all combinations of conditions that cause the same outcome [2].

In the context of FSQCA (Fuzzy Set Qualitative Comparative Analysis), a necessary variable refers to a condition or factor that is always present when the outcome or consequence being analyzed occurs. In other words, without the presence of this necessary variable, the desired outcome cannot occur. On the other hand, a sufficient variable is one that, when present alone or in combination with other variables, is capable of consistently producing the desired outcome. In this case, the sufficient variable can fully explain the outcome without the need for other variables.

The relationship between a necessary variable and a sufficient variable is that, in some cases, they can be the same variable. That is, a variable can be both necessary and sufficient to produce the desired outcome. However, it is also possible that a necessary variable alone is not sufficient to explain the outcome, or that a sufficient variable is not necessary in all cases.

FsQCA was originally developed by Charles Ragin [51]. It is an already novel research method that is attracting growing interest from the academic community. Evidence of this growing interest has been documented in bibliometric studies by Berger [6, 53]. Fuzzy set QCA is a variant of qualitative comparative analysis (QCA) and is one of the three approaches to QCA: csQCA, mvQCA and fsQCA. Its main characteristics are explained in Ragin [51].

Based on Ragin's [51] theoretical summary of the characteristics of fsQCA, main aspects of this methodology are as follows (some of them already explained): (i) fsQCA is based on set theory and Boolean logic, rather than a correlation-based approach; (ii) fsQCA relies on qualitative evidence based on small or medium-sized samples, although there is no limitation that prevents researchers from working with large data sets [69]; (iii) fsQCA allows for multiple conjoint causality, which is non-linear and non-probabilistic; it rejects permanent causality and allows for equifinality (equifinality implies that more than one path can lead to a specific outcome); (iv) fsQCA is used in regional analysis, amongst other disciplines, because of its advantages over correlation-based methods [24, 53].

The main steps to conduct an analysis using fsQCA have been described by Ragin [51, 55]. First step, researchers must identify the sample of relevant cases and the list of causal conditions (which can be thought of as variables) that are involved in a specific outcome. In our case, the causal conditions are the six factors defined by Hofstede [30] in his Six Dimensions Model (6-D), described on table of Figure 2. Furthermore, Outcome condition is the ratio of Perceived Opportunities, as defined by the Global Entrepreneurship Monitor, 2019.

Second step, authors must calibrate the conditions and the outcome. Calibration means identifying whether a condition (for a certain characteristic) is present or absent by assigning a value between 0 and 1 to the case. In other words, raw data are transformed to fuzzy-set data. FsQCA permits the use of continuous values ranging from 0 (fully-out) to 1 (fully-in). The recommended calibration method (applied in this work) is direct calibration. The value 0 is so assigned to denote the absence of the condition, while 1 is assigned to denote presence, and 0.5 is assigned to denote the point of maximum ambiguity [51].

Following the example provided by Ragin [51], we can generate the fuzzy-set version of Outcome and Conditions. We then establish the threshold based on our theoretical knowledge. As noted earlier, the direct method of calibration requires three anchors to identify whether the conditions are present or absent. Thus, we could establish thresholds for every variable, Outcome and Conditions, so that, for the former, we consider if the country is fully perceiving entrepreneurship opportunities, fully absent (maximum ambiguity), and on the border of the set. Same rationale applied for Conditions. The values and the explanation of the thresholds for our model are provided on table Figure 7.

After the calibration process, the third step is to generate the Truth Table. The Truth Table contains all logically possible combinations of the available conditions. The size of the truth table is 2^k , where k is the number of conditions. The configurations (combinations) that are not covered by real or observed cases are called logical remainders. A logical remainder is therefore a logically possible combination that is not covered by our cases [55].

Moreover, the truth table is reduced using a minimization algorithm. We performed the analysis using the R package developed by Medzihorsky [46]. Therefore, in this study, the minimization algorithm was the Quine-McCluskey algorithm. Depending on how the logical remainders are dealt with, fsQCA provides three different solutions: parsimonious, complex, and intermediate. The selection of an intermediate solution in the FSQCA sufficiency analysis allows capturing the complexity and variability present in the system under analysis, providing a more realistic and comprehensive view of the conditions that contribute to the desired outcome. Note that the three solutions never contradict each other. These solutions supply the possible combinations of conditions that lead to the outcome [51].

Summing up, fsQCA enables the comparison of cases to identify factors that cause a certain outcome. Unlike other methods, fsQCA is used to analyze the combined effect of variables on an outcome rather than isolated effects (dominant correlational approaches).

Finally, it should be beared in mind that regarding the parameters of fit, fsQCA has two main indicators: coverage and consistency. Coverage of a configuration refers to the percentage of cases that can be explained

by that configuration. On the other hand, Consistency reflects the degree of membership of a condition to a configuration. A minimum level of both measures is required to accept a solution as valid [26,51]. Therefore, fsQCA is suitable for studying our research question.

5. Results

FsQCA in this paper was conducted to validate Research Question about impact of socio-cultural and institutional factors on Entrepreneurship, as well as to contrast derived four hypotheses.

Regarding them, we could *a-priori* think that in current developed and globalized societies, with similar levels of access to information and interacting among them, levels of opportunities perceived by potential entrepreneurs should be also quite similar in all of them. However, this is not the case: evidence given by GEM data shows significative disparities among the 34 countries of the sample.

Moreover, according to the Research Model deployed in this work (Figure 1), 6-D variables constitute a necessary linkage or glue between national cultural framework of countries and their Entrepreneurship performance; furthermore, concerning these variables or conditions: should they be considered individually or otherwise under combinations? To answer these questions, following indeed fuzzy set qualitative comparative analysis shall let us understand the actual role of 6-D conditions, as well as interactions among them and with national cultural frameworks, as we will further discuss in the following epigraphs.

5.1. Is there any individual necessary condition?

According to research carried out, we were unable to identify a single necessary condition for the presence or absence of the outcome Perceived Opportunities (PO) - consistency should be above 0.9 and raw coverage above 0.5-. This is a first interesting result, because, although there are some countries in the sample with high values of outcome PO and of some of their 6-D condition (such as the US concerning value of Individualism and the UK for Individualism

and Indulgence- Figures 4 to 7); however, according to analysis of necessary conditions with fsQCA (Figure 9), neither of them lets individually explain the existence of PO.

Consequently, we next explored the same question for combinations of these conditions. Table of Figure 9 shows different combinations of conditions which would be necessary for the presence of the outcome, characterizing therefore the cultural framework for the arising of Perceived Opportunities of Entrepreneurship in most countries of the sample (Hypotheses 1 and 3).

Following this *Super-Subset* type of analysis, we reached to two possible combinations of conditions necessities for the arising of the outcome, both with values of Consistency very closed to 0.9, and those of Coverage higher than 0.5 (combinations numbered 1 and 2 on Table-Figure 10).

Figure 9: Analysis of necessary conditions.
Parameters of fuzzy set conditions.

Condition	PO ₊		~PO ₊	
	Cons.	Cover.	Cons.	Cover.
PD ₊	0.654587	0.649438	0.742350	0.681461
~PD ₊	0.678936	0.740123	0.618115	0.623457
IND ₊	0.726501	0.751611	0.582007	0.557118
~IND ₊	0.571914	0.596574	0.740514	0.714708
MAS ₊	0.686297	0.689028	0.744186	0.691302
~MAS ₊	0.692526	0.745277	0.665239	0.662401
UNCER ₊	0.556625	0.543394	0.835985	0.755113
~UNCER ₊	0.749151	0.831552	0.494492	0.507857
LTO ₊	0.617780	0.697125	0.652387	0.681150
~LTO ₊	0.717441	0.690463	0.709914	0.632153
INDUL ₊	0.697056	0.730998	0.620563	0.602138
~INDUL ₊	0.620612	0.638695	0.722766	0.688228

Source: Author's own research based on results of the variables in Figure 3.

Results from this second analysis of necessary blended conditions lead to an apparent paradoxical consequence: for the arising of Perceived Opportunities among potential entrepreneurs, there should mostly be in the society values regarding to Individualism, Masculinity, and Indulgence, taken together, not individually (bear in mind that there is not any individual necessary condition). Additionally, we got evidence of this result looking at specific cases of countries from the

sample, observing evolution of these factors as necessary conditions along national History of countries, (Hypothesis 2).

Taking the case of Japan for this aim, it shows an extraordinarily poor value of GEM PO (just 8.09 over 100), and medium values for Individualism and Indulgence (taken individually), but not for Masculinity, which reaches a score of 95 out of 100. Hofstede explains that “At 95, Japan was one of the most Masculine societies in the world. However, in combination with their mild collectivism, you do not see assertive and competitive individual behaviors which we often associate with Masculine culture. What you see is a severe competition between groups. From a very young age at kindergartens, children learn to compete on sports day for their groups (traditionally red team against white team)”. Is this individual feature of Masculinity in the case of Japan responsible for its whole behavior when dealing with Entrepreneurship? We cannot assure it from this fuzzy set qualitative comparative analysis, but we can indeed appreciate cultural singularities which could have led to these values of 6-D dimensions and PO.

There is not a wide literature that emphasizes the role of socio-cultural and institutional factors in Japan to explain this abnormally low value of PO, but some exceptions [34,45]. According to these authors, this low value should be related to social structures and ways of acting highly implanted in the past in Japan, especially during Edo and Meiji periods (1603-1867 and 1868-1912, respectively), but even earlier. Specifically, the low value of Perceived Opportunities should be related to the type of Japanese Family System implanted from the Tokugawa-Shogunate era (Edo), called *Ie* in Japanese written with Latin alphabet (Romaji). Although formal *Ie* System indeed disappeared after the Second World War, because of revision of the Civil Code at that time, and nowadays is growing the number of short nuclear families and even those with just one member, since current high penetration of individualism in Japanese society, it is however evident that de-facto *Ie* System remains strong among families in many parts of Japan, as a long-standing custom or as a moral value with diminished but still significant social force.

Furthermore, low values of Perceived and Capabilities Opportunities might also have to do with a basic dichotomy in the Japanese way of thinking, known as *Uchi and Soto*, related to the *Ie*

system as well. In this sense, *Uchi* can be defined as (1) inside, (2) my house and home, (3) the group that we belong to and (4) my wife or husband; in contrast, *Soto* distinguish insiders from outsiders in daily life depending on whether the others belong to an *uchi* or *soto* group. Although this distinction to some degree can be seen everywhere in the world, it is fundamental and widespread in Japan, where this dual concept has had a great influence on society, especially in terms of human relations [19]. Because of this dichotomy, it is understandable that any initiative that expels someone from a group (the company) will not be well received.

Finally, there is the fact that Japanese workers and managers still consider their companies as a sort of social club, concept calls in Japanese *Shakai no Kurabu* [21], referring not only to the junior-senior vertical structure of these companies, but also to the extended paternalism style of the largest ones, by the way, a hierarchical-Confucian style. In this sense, to understand procedures and organization of a Japanese company, it is indeed helpful to think of it in terms of a combination of three factors: an exclusive club, a sort of cooperative union and of course a business enterprise, because it incorporates attributes of the all three. This structure often also applies to the set of providers which depend on the larger firms for their day-to-day existence, and affects extraordinarily to the perception of opportunities and capabilities by Japanese professionals.

Figure 10: SuperSubset relations (presence of the outcome Perceived Opportunities).

	SuperSubset	Cons.	Cover.	Combined
1	IND_*LTO_*INDUL_	0.893213	0.506795	0.693870
2	IND_*INDUL_	0.865160	0.628539	0.760432
3	IND_*MAS_*INDUL_	0.864921	0.467724	0.655977
4	PD_*IND_*MAS_	0.905994	0.376557	0.601244
5	PD_*IND_*MAS_*LTO_	0.939873	0.336353	0.574131
6	PD_*IND_*LTO_*INDUL_	0.912698	0.325595	0.561985

Source: Author's own research

5.2. Magic recipes: analysis of sufficiency

Looking at the table of Figure 11, we may observe different combinations of conditions, explicitly present or absent, which have better values of Consistency and Coverage indicators. These combinations illustrate the strategies or recipes that lead to Entrepreneurship acceptable performance; in other words, these recipes are configurations that are sufficient for the presence of high values of PO.

Again, as we already made at analyzing necessary conditions, indicators used are those of inclusion, or consistency, and coverage, both raw and unique. Numerous authors consider consistency values that are greater than 0,8 to be acceptable [18, 26]. All four combinations from Figure 10 surpassed this threshold.

Moreover, although there is no established minimum value for coverage, we have set it at 0,45 as an acceptable minimum value for it in this context, according to Crilly [18] and Ragin [51]. Therefore, only three combinations met both criteria (numbered 1, 3 and 4). In any case, since coverage indicates empirical relevance, greater coverage would have implied greater empirical relevance of the solution.

Next table of Figure 11 shows the only successful combination which are sufficient for the arising of the outcome PO in the countries of the sample. We can see that just two conditions remained in all of them: Individualism and Indulgence, (Indiv*Indul), which stands out as a sufficient “magic recipe” for Entrepreneurship in the form of Perceived Opportunities (Hypothesis 4). Consequently, in the countries of the sample, national cultural frameworks in which remain some model of open thinking (Indul) together with low collective ways of action (Indiv), favor therefore higher values of outcome PO.

This result of sufficiency might seem paradoxical, but paradox or apparent contradiction is mostly solved considering that both factors of sufficiency should be taken combined, as well as fsQCA does not imply neither correlations among conditions and outcome nor single causality. Furthermore, due to impossibility of taking sufficient conditions individually, from this point, it is not possible to identify a set of countries which satisfy a pattern of sufficiency for presence of PO. However, what is indeed possible, as we did for necessary conditions, is to test this result against a specific country case.

We take again the case of Japan for this aim, since its case highlights the apparent paradox, presenting mid-high values of conditions taken individually (Indul and Indiv), but a very poor value of PO, and pointing in any case the key importance of both factors for the presence of the outcome.

Concerning Power of Distance, its current situation in Japanese society has much to do with lifetime employment system in Japan, called *Shu-Shin Koyo*, one of most talked facets of its traditional family-patterned company system, even though it has never been applied to the majority of the nation's workers, and nowadays it has been phased down if not out in many companies. De Mente [21] explains that, although a direct descendant of feudal times in Japan, when peasants and artisans were attached to a particular clan by birth and there was a social classes society, the lifetime employment system did not become characteristic of large scale modern Japanese industry until the 1950s. In fact, in the immediate post-war period, losing one's job was regarded as being sentenced to starvation. Consequently, to prevent employees from being fired or arbitrarily laid off, national federation union leaders took advantage of their new freedom and the still weak position of industry to force adoption of the lifetime employment system by the country's major enterprises. Under the lifetime employment system, all permanent employees of larger companies and government bureaus were, in practice, hired for life. These organizations generally hired once a year, directly from schools, so well before the end of the school year, each company and government ministry or agency decided on how many new people it wanted to bring in.

Figure 11: Analysis of sufficient conditions for presence of outcome: Intermediate solution.

PATHS	PD	IND	MAS	UNCER	LTO	INDUL	RAW COV.	CONSIT.
1	~	●		~		●	0.566251	0.930232
2	●	~		~	~		0.324462	0.956594
3	●	~	●		~	~	0.379389	0.876963
4	●	~	●	~			0.334655	0.862774
Overall Solution Consistency							0.774475	
Solution Coverage:							0.855606	
Cases with greater than 0.5 membership in term ~PD_*IND_*~UNCER_*INDUL_:							Sweden (0.83), United Kingdom (0.81), Ireland (0.77), Canada (0.76), Netherlands (0.75), United States (0.75), Switzerland (0.67), Finland (0.65), Norway (0.65), South Africa (0.63)	

Source: Author's own research

Note: As in Fiss[25], ● means presence of the condition and ○ means absence of the condition; Consistency cutoff: 1; Frequency cutoff: 0,873; Calculated as per Medzihorsky [45]); Analysis of the absence of the outcome was performed but has not been included in the paper

Moreover, regarding the cultural factor of Individualism in Japan, it is related to the fact that most Japanese workers have an extraordinary feeling of membership as regards to their companies (*Shudan Ishiki* in Japanese), so they are more willing to talk in terms of collectivity rather than individually.

6. Discussion, conclusion, and implications

This work has deepened in socio-cultural and institutional factors of Entrepreneurship, a quite well-developed one in terms of recent research but with some gaps that this paper tries to fill up. In this sense, the net contribution of this paper can be evaluated by the result achieved after applying fsQCA and country case analysis to a cross-country sample. This contribution is condensed in the Research Model shown on Figure 1.

Through applying Research Model, they are put into relationship with national cultural frameworks with Global Entrepreneurship Monitor's (GEM) performance indicators, setting up a qualitative comparative analysis among Hofstede Six Dimension factors (6-D) and GEM Perceived Opportunities by potential entrepreneurs. This is something new, partially treated before by Fernández [25, 42, 47, 70].

In this way, it has been possible to answer and validate the Research Question through testing Hypotheses (Hip.) 1 to 4, about impact of cultural factors on Entrepreneurship, as well as about which Hofstede factors (alone or combined) are necessary and sufficient for the arising of perceived opportunities of new businesses. More in detail, results obtained have been the following:

- For the arising of perceived opportunities among potential entrepreneurs, there should mostly be in the society values regarding Individualism, Masculinity, and Indulgence, taken together, not individually (*Hyp. 1 and 3*).
- It is possible to get evidence of necessary conditions looking at specific cases of countries from the sample, observing evolution of these factors as necessary conditions along the history of countries, (*Hyp. 2*). Taken for this aim, the country-case of Japan.

- Among countries of the sample, national cultural frameworks in which remain some model of social open thinking (Indul), together with low collective ways of action (Indiv), favor higher values of outcome PO (*Hyp. 4*).

However, despite results achieved and the usefulness of their implications, this study has limitations that suggest future areas of research.

Firstly, sample size of sixteen countries could be enlarged, favoring generalization of results. Secondly, consistency and coverage of Necessary and Sufficiency analyses might be both higher, improving relevance of overall results. How to improve these indicators should be part of further research, although three possible vias can be pointed out now: modify calibration criteria, revise input-data, both for Hofstede Dimensions and for GEM PO, and changing PO indicator for other GEM ones, such as the Entrepreneurial Intentions [25].

Finally, future research should be addressed to the normative arena, that is, to analyze how to foster national Entrepreneurship under a determined Culture by policy makers, to make the necessary *aggiornamento* of countries entrepreneurship ecosystems.

7. Bibliography

- [1] Acs ZJ, Estrin S, Mickiewicz T, Szerb L. Entrepreneurship, institutional economics, and economic growth: an ecosystem perspective. *Small Bus Econ.* 2018;51(2):501-14. doi: 10.1007/s11187-018-0013-9.
- [2] Alamá Sabater L, Budí Orduña V, García Álvarez-Coque JM, Roig-Tierno N. Using mixed research approaches to understand rural depopulation.
- [3] Álvarez-Coque JMG, Mas-Verdú F, Roig-Tierno N. Technological innovation versus non-technological innovation: different conditions in different regional contexts? *Qual Quant.* 2017;51(5):1955-67.
- [4] Angulo-Guerrero MJ, Pérez-Moreno S, Abad-Guerrero IM. How economic freedom affects opportunity and necessity entrepreneurship in the OECD countries. *J Bus Res.* 2017;73:30-7. doi: 10.1016/j.jbusres.2016.11.017.
- [5] Aoyama Y. Entrepreneurship and Regional Culture: The Case of Hamamatsu and Kyoto, Japan. *Reg Stud.* 2009;43:495-512.
- [6] Berger ES. Is qualitative comparative analysis an emerging method? —Structured literature review and bibliometric analysis of QCA applications in business and management research. *Complexity in entrepreneurship, innovation, and technology research.* 2016:287-308.

- [7] Bosma N, Kelley D. Global Entrepreneurship Monitor: Global Report 2022/2023. Electronic ed.: www.gemconsortium.org.
- [8] Barro R, Sala-I-Martin X. Regional growth and migration: A Japan-United States comparison. 1992;6(4):312-46.
- [9] Barro R, Sala-I-Martin X. Economic Growth. 2nd ed. Massachusetts: MIT Press; 2003.
- [10] Benedict R. The Chrysanthemum and the Sword. Patterns of Japanese Culture. Rev. ed. Hong Kong: Tuttle; 1989.
- [11] Brown RA. Capital and Entrepreneurship in South-East Asia. Rev. ed. London: McMillan; 2016.
- [12] Bygrave W, Hay M, Ng E, Reynolds P. A study of informal investing in 29 nations composing the Global Entrepreneurship Monitor. *Venture Cap Int J Entrep Financ.* 2003;5(2).
- [13] Cacciotti G, Hayton JC. National Culture and Entrepreneurship. *The Wiley Handbook of Entrepreneurship.* 2017;401-22. doi: 10.1002/9781118970812.
- [14] Cameron R. *Historia Económica Mundial.* Madrid: Alianza Editorial; 1990.
- [15] Castaño MS, Méndez MT, Galindo MÁ. The effect of social, cultural, and economic factors on entrepreneurship. *J Bus Res.* 2015;68(7):1496-500. doi: 10.1016/j.jbusres.2015.01.040.
- [16] Castaño-Martínez MS, Méndez-Picazo MT, Galindo-Martín MÁ. Policies to promote entrepreneurial activity and economic performance. *Manag Decis.* 2015;53(9):2073-87. doi: 10.1108/MD-06-2014-0393.
- [17] Castells M, Cardoso G, editors. *The Network Society: From Knowledge to Policy.* Washington, DC: Johns Hopkins Center for Transatlantic Relations; 2005.
- [18] Crilly D. Predicting stakeholder orientation in the multinational enterprise: A mid-range theory. *J Int Bus Stud.* 2011;42(5):694-717.
- [19] Debroux PD. The search for a new entrepreneurial drive in manufacturing in Japan. *Int J Entrep Innov Manag.* 2003;1:317-28.
- [20] Davies RJ, Ikeno O. *Japanese mind: Understanding contemporary Japanese culture.* Tuttle Publishing; 2011.
- [21] De Mente BL. *Japan. Understanding & dealing with the new Japanese way of doing business.* Phoenix-USA: Phoenix Books Publisher; 2012.
- [22] EstradaCruz M, VerdúJover AJ, GómezGras JM. The influence of culture on the relationship between the entrepreneur's social identity and decision-making: Effectual and causal logic. *BRQ Bus Res Q.* 2019;22(4):226-44. doi: 10.1016/j.brq.2018.10.002.
- [23] Evans G, Honkapohja S, Romer P. Growth Cycles. NBER Working Paper. Rev. ed. 2000;w5659.
- [24] Fan D, Li Y, Chen L. Configuring innovative societies: The crossvergent role of cultural and institutional varieties. *Technovation.* 2017;66:43-56.
- [25] Fernández J, Liñán F, Santos FJ. Cognitive aspects of potential entrepreneurs in Southern and Northern Europe: An analysis using GEM-data. *Rev Econ Mund.* 2009;(23):151-78.
- [26] Fiss PC. Building better causal theories: A fuzzy set approach to typologies in organization research. *Acad Manag J.* 2011;54(2):393-420.
- [27] Grossman GM, Helpman E. Endogeneous innovation in the theory of Growth. *J Econ Perspect.* 1994.

- [28] Gutierrez JR. What brings about success in Japanese companies? Madrid: Shacho Kai; 2018.
- [29] Gutierrez JR. Impact of Cultural Factors on Entrepreneurship: Evidence from GEM Model and the Singularity of Japan. Handbook of Research on Ethics, Entrepreneurship and Governance in Higher education. 2019;Chapter 20:433-54.
- [30] Hampden-Turner C, Trompenaars F. Riding the waves of culture: Understanding diversity in global business. 2020.
- [31] Hawkins DI. New business entrepreneurship in the Japanese economy. J Bus Ventur. 1993;8:137-50.
- [32] Hofstede G. Culture's Consequences: International Differences in Work-Related Values. 2nd ed. Beverly Hills CA: SAGE Publications; 1984. Electronic ed.: <https://geerthofstede.com/culture-geert-hofstede-gert-jan-hofstede/6d-model-of-national-culture/>.
- [33] Hult GTM, Snow CC, Kandemir D. The Role of Entrepreneurship in Building Cultural Competitiveness in Different Organizational Types. J Manag. 2003;29(3):401-26. doi: 10.1016/S0149-2063_03_00017-5.
- [34] Inglehart R. Mapping Global Values. Comp Sociol. 2006;5(2-3).
- [35] Kase K, Slocum A, Zhang YY. Asian versus Western Management Thinking. London: Palgrave Macmillan; 2011.
- [36] Kenji K. Innovation and Entrepreneurship in Japan: Why Japan (Still) Matters for Global Competition. SVNJ Working Paper. 2017;2.
- [37] Kerr A. Lost Japan, last glimpse of beautiful Japan. London: Penguin; 2015.
- [38] Kneller R. The beginning of university entrepreneurship in Japan: TLOs and bioventures lead the way. J Technol Transf. 2007;32:432-56.
- [39] Kauffman Foundation. National Report on Early-Stage Entrepreneurship, 2018. www.kauffman.org.
- [40] Kreiser PM, Marino LD, Dickson P, Weaver KM. Cultural influences on entrepreneurial orientation: The impact of national culture on risk taking and proactiveness in SMEs. Entrep Theory Pract. 2010;34(5):959-83. doi: 10.1111/j.1540-6520.2010.00396.x.
- [41] Lee SM, Peterson SJ. Culture, entrepreneurial orientation and global competitiveness. J World Bus. 2000;35(4):401-16.
- [42] Liñán F, Rodríguez Cohard JC, Rueda-Cantuche JM. Factors affecting entrepreneurial intention levels: a role for Education. Int Entrep Manag J. 2011;7(2):195-218.
- [43] Levie J, Autio E. A theoretical grounding and test of the GEM model. Small Bus Econ. 2008;31(3):235-63.
- [44] Lucas R. On the Mechanics of Economic Development. J Monet Econ. 1988;22(1):3-42.
- [45] Maddison A. The World Economy: A millennial perspective. Paris: OECD Development Centre Studies; 2001.
- [46] Masuda T. The Determinants of Latent Entrepreneurship in Japan. Small Bus Econ. 2006;26:227-40.
- [47] Medzihorsky J, Oana IE, Quaranta M, Schneider CQ. SetMethods: functions for set-theoretic multi-method research and advanced QCA. R package version. 2016;2.1.

- [48] Méndez-Picazo MT, Galindo-Martín MA, Castaño-Martínez MS. Effects of sociocultural and economic factors on social entrepreneurship and sustainable development. *J Innov Knowl.* 2020;6(2):69-77. doi: 10.1016/j.jik.2020.06.001.
- [49] Mokyr J. *A culture of Growth. The Origins of the Modern Economy.* Princeton and Oxford: Princeton University Press; 2016. 50
- [50] Nissan E, Galindo MA, Picazo MTM. Innovation, progress, entrepreneurship and cultural aspects. *Int Entrep Manag J.* 2012;8(4):411-420.
- [51] Ragin CC. *Fuzzy-set social science.* Chicago: University of Chicago Press; 2000.
- [52] Ragin CC. *Redesigning social inquiry: Fuzzy sets and beyond.* Chicago: University of Chicago Press; 2008.
- [53] Ragin CC. *The comparative method: Moving beyond qualitative and quantitative strategies.* Berkeley: Univ of California Press; 2014.
- [54] Rob A, Morelix A. *Startup Financing Trends by Race: How Access to Capital Impacts Profitability.* Annual Survey of Entrepreneurs Data Briefing Series. Kauffman Foundation; 2016.
- [55] Roig-Tierno N, Gonzalez-Cruz TF, Llopis-Martinez J. An overview of qualitative comparative analysis: A bibliometric analysis. *J Innov Knowl.* 2017;2(1):15-23.
- [56] Sagie A, Elizur D. Entrepreneurship and culture as correlates of achievement motive: a multifaceted approach. *Int J Entrep Innov Manag.* 2003;1:34-52.
- [57] Schneider CQ, Wagemann C. *Set-theoretic methods for the social sciences: A guide to qualitative comparative analysis.* Cambridge: Cambridge University Press; 2012.
- [58] Senor D, Singer S. *Start-up Nation: The Story of Israel's Economic Miracle.* New York: Twelve; 2009.
- [59] Solow R. A Contribution to the Theory of Economic Growth. *Q J Econ.* 1956;70(1):65-94.
- [60] Staniewski MW. The contribution of business experience and knowledge to successful entrepreneurship. *J Bus Res.* 2016;11:5147-5152.
- [61] Sternberg R, Wennekers S. Determinants and Effects of New Business Creation Using Global Entrepreneurship Monitor Data. *Small Bus Econ.* 2005;24:193-20.
- [62] Shumpeter JA. *Capitalism, Socialism, and Democracy: Third Edition.* London: Harper Collins; 2008.
- [63] Solesvik M, Westhead P, Matlay H. Cultural factors and entrepreneurial intention: The role of entrepreneurship education. *Educ Train.* 2014;56(November):680-696. <https://doi.org/10.1108/ET-07-2014-0075>.
- [64] Spencer JW, Gómez C. The relationship among national institutional structures, economic factors, and domestic entrepreneurial activity: A multicountry study. *J Bus Res.* 2004;57(10):1098-1107. [https://doi.org/10.1016/S0148-2963\(03\)00040-7](https://doi.org/10.1016/S0148-2963(03)00040-7).
- [65] Suzuki II, Hoonkim S, TaeBae Z. Entrepreneurship in Japan and Silicon Valley: a comparative study. *Technovation.* 2002;22:595-606.
- [66] Terjesen S, Hessels J, Li D. Comparative international entrepreneurship: A review and research agenda. *J Manag.* 2016;42(1):299-344.
- [67] Thornton PH, Ribeiro-Soriano D, Urbano D. Socio-cultural factors and entrepreneurial activity: An overview. *Int Small Bus J.* 2011;29(2):105-118.
- [68] Uhlaner L, Thurik R. Postmaterialism influencing total entrepreneurial activity across nations. *J Evol Econ.* 2007;17(2):161-185.

- [69] Urbano D, Toledano N, Ribeiro-Soriano D. Socio-cultural factors and transnational entrepreneurship: A multiple case study in Spain. *Int Small Bus J*. 2011;29(2):119-134. <https://doi.org/10.1177/0266242610391934>.
- [70] Urbano D, Aparicio S, Audretsch D. Twenty-five years of research on institutions, entrepreneurship, and economic growth: what has been learned? *Small Bus Econ*. 2019;53(1):21-49. <https://doi.org/10.1007/s11187-018-0038-0>.
- [71] Vis B. The comparative advantages of fsQCA and regression analysis for moderately large-N analyses. *Sociol Methods Res*. 2012;41(1):168-198.
- [72] Wach K. Impact of cultural and social norms on entrepreneurship in the EU: Cross-country evidence based on GEM survey results. *Zarządzanie w Kulturze*. 2015;16(1):15-29.
- [73] Woodside AG, Bernal PM, Coduras A. The general theory of culture, entrepreneurship, innovation, and quality-of-life: Comparing nurturing versus thwarting enterprise start-ups in BRIC, Denmark, Germany, and the United States. *Ind Mark Manag*. 2016;53:136-159. <https://doi.org/10.1016/j.indmarman.2015.11.003>.
- [74] World Bank. Educational Statistics. 2019. Available from: www.databank.worldbank.org.
- [75] Wu C. Global entrepreneurship and innovation in management: Comparing MRA/SEM versus fuzzy-set QCA theory creation, data analysis, and findings. *J Bus Res*. 2016;69(6).

Impact of rural tourism on small municipalities in the interior of the province of Castellón

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Abstract

The objective of this work is to identify the degree of economic dependence of a set of economic activities in relation to tourism and the number of visitors associated with it. The study focuses on municipalities at risk of depopulation located in rural areas with low population density and low economic dynamism, where tourism is centered around the second home model. According to this typology of tourists (non-residents for the purposes of the research), the study focuses on the impact of the expenditure made by non-residents on the set of activities existing in these municipalities. Specifically, it analyzes the effect on the annual revenue of businesses selling food products and bars and restaurants. The study uses in-depth interviews to detect the perceived effect of tourism activity (non-residents) on the annual revenue of the restaurant sector (bars and restaurants) and food product commercialization activities. The study is based on the idea of the multiplier effect of these services and their capacity to maintain a minimum diversification of the local economy, as well as a minimum market size, as prerequisites for combating depopulation. The results indicate that the dependence on tourism for food commerce activities is greater the further the municipality is from the commercial center that represents the regional capital. In the case of the restaurant sector, the results are not as conclusive (showing greater

disparity), possibly because the internal characteristics of each business and the different attractions of the municipality where they are located should be further refined.

Keywords: Economic impact, tourism, second home, depopulation.

1. Introduction

The origin of rural tourism is often associated, at least in its initial state and from the supply-side perspective, with the search for an economic activity aimed at complementing the scarce income derived from subsistence agriculture. Over time, it has evolved from merely a complementary activity to a true economic alternative for rural areas and, later, to a genuine strategy for endogenous territorial development (Carrillo, 2002; Cánoves and Villarino, 1997).

For this reason, rural tourism has transformed from the initial concept mentioned earlier, which was exclusively linked to the idea of a complementary activity to the primary sector (whose most prominent example in Spain was the Casas de Labranza program) to a tourism that develops both from the proliferation of second homes in rural and agricultural areas (Soret, 1999) and thanks to changes in tourist demand (with tourists becoming increasingly sensitive to environmental issues, seeking less crowded destinations, outdoor adventure and sports activities in nature, etc.).

Subsequently, with the rural tourism development plans initiated by the different autonomous communities, the objectives expanded to include the conservation of architectural heritage (through the recovery of homes for tourism use, many of which had been abandoned during the process of de-ruralization and urbanization in Spain during the years of developmentalism), the promotion of income that acts as a complement to purely agricultural earnings, the revaluation of both cultural and environmental spaces, and finally, the conception of rural tourism as a strategy for endogenous development to combat depopulation (Sánchez and Sánchez, 2018; Vera, 2013). The case under consideration would fall within the group of rural areas to be revitalized, meaning those with low population density,

low income levels, and significant geographic isolation or territorial cohesion difficulties, and not necessarily a high significance of agricultural activity.

The presence of tourism in these rural areas corresponds to a low-intensity activity, with a basic offering of tourism services, where the second home tourism model predominates. The existing tourism offering corresponds to microenterprises, almost always of a family nature, whose activity is sustained by the valorization of rehabilitated family heritage, and for whose owners tourism is often just an economic-labor complementary activity. The result is a network of weak businesses from an entrepreneurial perspective, with low financial capacity for investment, training, and growth, predominantly family businesses, where there are justified doubts about their economic sustainability in the medium term (Vázquez and Martín, 2011).

With this approach to tourism activity, the impact on the territory will depend both on the ability to attract tourists and the existence of a significant number of rural tourism accommodations. All evidence suggests that there is a certain demand, which ultimately promotes (through tourist spending) the increase and diversification of employment. Thus, the central element for transforming tourism into a tool for local development and, by extension, as a strategy to combat depopulation, is to determine the extent to which the presence of tourists contributes to the diversification of production and the service offering in the municipalities under study.

In this context, and if we consider the peculiarities of rural tourism in areas with low tourism offering and business weakness (also characterized by high seasonality, concentrated in the month of August, being a weekend and holiday bridge activity), it is difficult to think that this activity can become the engine of rural development for all sparsely populated rural municipalities. Therefore, and in line with Maroto and Pinos (2019), we propose the hypothesis that “tourism alone is not capable of halting rural depopulation in the municipalities where it is implemented. Only where rural tourism is able to integrate into an existing, minimally diversified economic structure with the capacity to value various territorial resources that have attraction potential, there will be possibilities for achieving positive demographic dynamics.”

Regarding the objective of economic development and value creation in non-urban areas, the importance of tourism in economic terms is generally measured from the supply side, that is, by quantifying both the volume of resources allocated to this activity and the tourism products offered in the territory. Alternatively, especially in smaller and rural tourism-specialized areas, tourism employment data is also used as an approximate indicator of the sector's weight, limiting tourism employment to the activities included in the Satellite Tourism Account in Spain (CSTE) developed by the INE, and identified with CNAE codes at the three-digit level.

An alternative to these methods is to quantify not the supply but the demand, which in some cases allows us to have information from visitor control established at certain tourist points of interest. These controls (which do not necessarily involve payment, but merely access control and/or capacity monitoring) are often justified by arguments for protecting the tourist asset: environmental arguments for natural and landscape resources, and heritage arguments for architectural and cultural resources, etc. The important thing for our purposes is that, starting from these considerations and both direct and indirect indicators, it is also possible to determine the importance of tourism at the territorial level and in specific municipalities within an area (even when, due to the reduced population and economic size of the locality, available information is scarce or even nonexistent).

Focusing on the Valencian Community, in this autonomous community, a regulation (recently modified) has been designed that regulates the concept of a tourist municipality based on the importance of this activity in both employment and the local economy, in comparison to the data for the entire region. The consideration of a tourist municipality allows eligibility for promotional aid for tourism activity, while also requiring specific development and governance plans. Municipalities applying for this recognition must meet a set of criteria proposed by the regulation, including the so-called Economic Criterion, which seeks to determine the importance of tourism activity as the base of the local economy or, at least, a significant part of it. Compliance with this criterion will be based on two indicators:

The employment generated by tourism activity.

The influence of tourism activity on the municipal economy.

The criterion will be considered accredited when the result of both indicators is equal to or greater than the results determined by the latest study on the impact of tourism on the economy and regional employment in the Valencian Community, conducted by the relevant tourism department. In practice, due to the limitation of municipal data availability, except in large cities with sufficiently detailed information (CNAE three-digit level), in many cases (especially in rural areas), only tourism employment data is analyzed as an indicator of economic relevance. The result of this analysis allows for granting the recognition label, which acknowledges the importance of tourism activity based on the municipality's size (distinguishing between tourist municipalities of excellence, relevance, or uniqueness).

To know the level of tourism employment in each municipality and compare it with the total for the region, activities listed in the CSTE are used as a reference and quantified locally, with the issue of data availability at the local level in smaller municipalities.

Thus, taking the CSTE as a reference, available data from the Social Security Employment Register and the Public Employment Service (SEPE) are used, collected by the Valencian Institute of Statistics, which provides information on the number of employees for each of the 21 activity sections in which employment is classified. The sections are identified with letters from A to U, with sections I (Hospitality) and R (Artistic, Recreational, and Entertainment Activities) being the most relevant for tourism employment purposes. This adjustment to two activity sections excludes part of the tourism-related employment covered by the CSTE, such as activities related to transport services and real estate management. Observations of activity licenses indicate that these businesses are typically not present in small municipalities at risk of depopulation, being located in larger municipalities, especially regional capitals, which generally do not form part of municipalities identified as at risk of depopulation due to their disparate behavior compared to their own regional cluster.

As indicated, granting the status of a tourist municipality (or, in line with the interest of this work, understanding the importance of tourism within the local economy) is particularly complex for certain small rural municipalities due to the need for detailed, highly disaggregated information (as available data is insufficient,

and obtaining greater detail faces restrictions from current statistical confidentiality legislation). In this context, the main question is: How can these municipalities justify the weight of tourism activity in their territory?

2. Objective

If we revisit the initial approach, conceiving rural tourism as a tool to complement agricultural income (or, in some cases, other types) and anchor the population to the territory, the question we ask in this paper is whether we can understand, despite the scarcity and precariousness of available data for many small municipalities, the real impact of tourism on other activities and, by extension, on the entire local economy. All of this is aimed at enabling the inclusion of these municipalities in the Valencian Community's list of municipalities of tourist excellence, relevance, or uniqueness, which, in a broader sense, implies considering tourism as a relevant activity in the economic structure of these localities.

This central issue becomes particularly significant, as we have just mentioned, in the case of small municipalities where, regardless of inclusion in the list of tourist municipalities and the advantages it entails, the survival of some key economic activities for the survival of the municipality itself depends on the existence of a regular flow of tourists (and this is the case even though some of these activities may not seem, at least initially, dependent on tourist flow). It is evident that this issue is not exclusive to municipalities at risk of depopulation and is present by definition in all tourist areas where most hotel and catering activities are almost exclusively intended for tourist use.

However, for these small localities, the continuity of some of these activities (specifically, food-related commerce in general, as well as, particularly, specific activities such as bakeries) is crucial as a private service to citizens, which could severely affect the survival of the municipality itself. The same applies to bars and, to a much lesser extent, restaurants, which are often configured as centers of social activity in the locality.

As noted by Navarro et al. (2025), the existence of a certain supply of tourist accommodations is crucial, particularly because it allows travelers to stay several days in the area, providing an opportunity to explore existing tourist resources and encouraging tourist spending to improve the local economy. However, this paper does not limit the capacity to anchor the population to the territory solely to the economic dynamism directly related to population volume or the usual tourist supply. The interpretation of Navarro et al.'s assertions in this work focuses on the supply of private commercial services (catering and food commerce) as the central element. This hypothesis is tested for the municipalities of the Valencian Community and, specifically, for the province of Castellón, where all the municipalities under study are located less than an hour away from major urban and service areas.

In this regard, and as previously indicated, the objective of this paper is not limited to the tourism sector *stricto sensu* but extends to other commercial activities considered fundamental in the territory, in order to assess the degree of economic dependence of these activities on tourism, as a result of the multiplier effect of local spending. In other words, the goal is to conceptualize the study area as a “deep” rural space (Ivars, 2000), without analyzing other elements that influence its tourist product offer or other resources that attract tourists to the territory, such as landscape or heritage elements. In the case at hand, with rural areas of low population density and low economic dynamism, tourism is primarily based on a model centered around second homes (since these are not consolidated tourist destinations, most of these homes are linked to family ties—ancestors from the municipality—as well as social identification with the territory). In fact, it is reasonable to admit the relative lack and precariousness of infrastructure, as well as services that could promote the offer of quality tourist products, based on resources with low attraction capacity (Navarro et al., 2005).

Regarding specialized literature, recent studies focusing on the depopulation problem highlight the importance of economic conditions, accessibility (connectivity and easy access to the territory), and public infrastructure, as well as an adequate provision of essential public and private services, as necessary conditions for anchoring the population to the territory (Alamá et al., 2021). Among these services are healthcare and education, both linked to the public sector, as well

as commercial or hospitality services (food stores, bars, restaurants, etc.) related to the private sector. The aforementioned study also shows the relevance of the concept of economic dynamism in the territory, as well as the need to ensure a minimum diversification of the local economy as a requirement to combat depopulation.

Another key aspect in the analysis of depopulation is the problem of the small size of the market faced by the local economy. In this context, when activities are marketable outside the local environment, the strategy is to expand the market through online instruments and mechanisms (Budí and Alamá, 2022). However, when the characteristics of the goods or services sold confine the market to the municipal area, the solution necessarily involves increasing the number of potential clients, which, in this case, would mean increasing the flow of tourist visitors, thus partially mitigating the small market size. It is precisely this context that this paper aims to address, attempting to establish a connection between tourism (potential clients for food commerce, as well as bars and restaurants) and the survival of some of these services that are considered basic (for residents not to relocate) in municipalities at risk of depopulation.

Specifically, the key question is to determine to what extent certain commercial activities, focused on the food sector, as well as certain restoration activities, depend on tourism to guarantee the minimum annual income necessary to make them profitable. In other words, we ask how many activities (even if they are not initially fully associated with tourism) could not persist without the income (often merely seasonal) from tourism. In such a case, the jobs associated with these activities should also be counted when measuring the weight of the tourism sector in the locality. This consideration also situates the research within the field of territorial resilience, linking the presence of certain private services with the ease of maintaining the population and, of course, the potential attraction of new residents.

The goal of this paper is to determine to what percentage the continuity and resilience of these activities depend on the presence of tourists, as we are dealing with an insufficiently sized local market. This situation places the research within the field of studies on the perceived impact of tourism activity and how it extends to the economic activities present in these municipalities (Ozturk et al., 2015). We must

take into account that, to the extent that a greater effect of tourism is perceived in these activities, it will result in a better perception of the entire territory's importance regarding tourism activity and its implications in stimulating the local economy (Riyanto et al., 2023).

3. Methodology

Since the objective is to determine to what extent the commercial activities of small municipalities related to food (including mixed stores, convenience stores, grocery stores, bakeries, etc.) and catering services (mainly typical village bars or cafes, although also higher-end restaurants in some cases) depend on tourism, it is necessary to identify the clients based on whether they are tourists or residents. This distinction is possibly the key element in the fieldwork and requires establishing a central assumption: the ability to identify the residence of a client. In this sense, the idea commonly held in small municipalities of “we all know each other” is invoked, and regarding establishments, it is confirmed that they are able to identify their clients and indicate whether they are regular residents or tourists or those maintaining a connection with the territory through a second home.

Thus, the central assumption of the work required a prior question at the beginning of the interviews, where this central issue in the research was highlighted. In all cases included in the study, a positive response was obtained (otherwise, the establishment in question would be excluded from the analysis), which helps to reduce the bias (which is already high) of the in-depth interview method employed.

Once this issue was resolved, it was necessary to know the spending of each group in order to quantify tourist spending (i.e., spending exclusively by tourists) relative to total spending in these activities. That is, to define the degree of resilience of these activities (in most cases microenterprises) and to what extent this behavior depends on the income obtained from clients classified as tourists (non-residents).

As a means of approaching these data, in-depth interviews with managers of these establishments in municipalities at risk of depopulation were conducted, aiming to identify the impact of tourism (Jennings, 2005). The interviews provided a series of repeated and

general statements and considerations that, despite their subjectivity (essentially, the opinions of the interviewees), were tested by sequential questions, granting them both external and internal validity and relative reliability (Gibbert et al., 2008). Generally, those arguments that accumulated in the majority of interviews were considered valid, following the methodology of comparative case studies (Gupta and Guillén, 2008).

Fieldwork was conducted in person in municipalities at risk of depopulation in the Alto Palancia region (in the southern interior of the Castellón province), with a total of 25 interviews carried out between July 2023 and May 2024. Regarding the characteristics of the 29 municipalities in the region, there is a small group of 5 municipalities (including the regional capital, Segorbe, which is also the most populated) without depopulation problems, while the remaining 24 face the demographic challenge of depopulation, though with varying degrees of severity. The target population is characterized by microenterprises, mostly self-employed, predominantly consisting of two workers (mostly members of the same family structure, i.e., couples), and with predominantly male ownership (who also serve as the business managers).

The interview allowed for obtaining data on business ownership, the activity segment, the number of employees (including owners), and the basic characteristics of the contract (mainly regarding the contract's temporality), the potential familial relationship between employees, and, as a key element, the importance of clients considered as tourists for their activity. To draw certain conclusions, a criterion of distance to larger municipalities was also established, considering a single isochrone based on whether travel time was above or below 10 minutes (by private vehicle).

A central issue in this work was confirming that the interviewee could differentiate between residents and non-residents within their clients, in order to determine (through a calculation or personal estimation) the weight and importance of each group relative to the annual turnover of the business. The criterion of residence is applied in this case above other criteria, such as being registered in the municipality, both due to the impossibility of confirming this by the interviewee and because the final objective is to identify those clients

who form the universe of tourist visitors, whether they belong to the main group of families with family ties in the municipality and the possibility of a second home, or whether we are referring to other groups with tourist rentals regardless of duration, or even excursionists who do not stay overnight in the municipality.

As mentioned, at this point in the study, the interviewee is asked to confirm that they can identify their clients to the point of knowing whether they reside in the municipality on a regular basis. Likewise, it is also particularly important at this point to distinguish between a regular resident client throughout the year and one who, even if they own property in the municipality, is only a client at specific times tied to vacation periods (Christmas, Easter, local festivals, summer period...), as the latter is considered, for the purposes of this study, as a non-resident regular client, tourist, or simply (using a common term in these municipalities) a summer resident. It should be noted that, in this type of activity, especially in small municipalities with a high degree of social relations, it is not surprising that business managers know their clients to the level required for this research.

To achieve this objective during the interview (and with the idea of understanding the business's operation in the greatest detail possible), a specific item was included, either directly or indirectly, with a question about the importance of sales to non-resident clients (summer residents) in relation to the total annual sales. Several direct questions were used for this, such as:

- What is the value of sales to non-regular residents in the municipality relative to total sales?
- What percentage of sales is to non-residents (summer residents) relative to the total?

The responses obtained were not entirely precise in terms of providing an exact percentage of turnover, but were generally given as either percentage ranges or generic statements such as:

- Without what we sell to outsiders (non-residents), we couldn't live and would have to close.
- Half of what we sell is to outsiders (summer residents).

- At least a quarter (or a third).
- August sales are more than double those of a normal month.
- From the second half of July through August, I sell a quarter of what I sell all year.
- It's very little, about 10% of total sales.
- Almost all who come are from outside (non-residents).

It should be noted that, in some cases, to fine-tune the response, a specific percentage was proposed during the interview that the interviewee considered to match their initial generic response.

Regarding the previous questions, and when posed to businesses in the bar and restaurant sector, the responses showed a tendency to be at the extreme values, identifying some establishments that depend almost exclusively on tourism (i.e., summer residents as defined above).

During the interview process, it was also asked whether additional workers were hired during the period of highest activity (especially in cases where an increase in sales was mentioned). The responses were distributed into three categories: establishments that directly state that they hire and provide both the number of employees and the duration of the contract; those who resort to their family structure on an ad-hoc basis; and a third group that answers vaguely, which may indicate occasional collaboration from family members or other workers, but without formal hiring.

4. Results

The main results of the fieldwork allow us to quantify the percentage (specific value or percentage range) that sales to non-residents (vacationers) represent of the total annual sales. The results obtained from the sample show two different types of outcomes, depending on whether the business is a food establishment (supermarkets, grocery stores, bakeries, etc.) or a bar or restaurant.

In the case of food establishments, sales to non-residents range between 20% in municipalities closer to the district's capital (where

the commercial attraction capacity of the capital plays a role, as it also has a better commercial service infrastructure in addition to other public services) and up to 50% in more distant towns. As for bars and restaurants, the figures range between 20% and 40% for bars, and above 50% for restaurants, with some cases approaching 100% of their activity being related to tourism.

The detailed analysis of the interviews provides information on the perception of income based on the age range of the interviewees, showing greater involvement of tourism in the younger age groups (under 45 years). However, the result by age is not conclusive due to the limited variability of observations in the under-45 age range.

An interesting aspect is the perception of alternative employment opportunities and the level of economic dynamism. In general, the opinion regarding the possibilities that tourism activity offers for the future of the business (and, in general, for the municipality) is more favorable than expected, despite many of these towns being at risk of depopulation, with low economic activity and a stagnant labor market.

Finally, it is worth mentioning a widely held perception regarding the difficulties (or rather the impossibility) of transferring commercial activities, which affects potential investments for the improvement or upgrading of establishments. In general, there are observations indicating doubts about the continuity of the business, especially in cases where sales to non-residents are lower. These results differ in the case of bars and restaurants, which, due to their greater reliance on non-residents, are more confident about the future and even consider the transfer of the business to be more feasible or viable.

5. Conclusions

The results obtained from this initial approach, both to the problem and the methodology used to attempt to solve it, confirm the importance of tourism for municipalities at risk of depopulation; a relevance that, importantly, goes beyond the weight traditionally attributed to tourism when using conventional and orthodox measurements.

The data indicate that the dependence on tourism, for retail food commerce activities, is greater the farther the municipality is from the

commercial hub representing the district's capital; conversely, in the case of restaurant activities, the results are not as conclusive, showing more variability, possibly because the internal characteristics of each business, as well as the different tourist attractions of the municipality where they are located, should be further considered.

The effect of rural tourism on the local economy extends across all activities, and in municipalities at risk of depopulation, it contributes to maintaining certain commercial activities that are considered essential services for the continuity of the population in the territory. The results of this preliminary study would support the proposal to guarantee, with public resources, certain minimum incomes to ensure the continuity of these activities (conditioning these contributions to variables such as: population size and evolution of depopulation risk, distance to commercial hubs at the district level, etc.).

The results show both the transversal effect of tourism on other activities and its unexpected role as a tool for settling the population in the territory, beyond traditional measurements of tourism's weight in small rural municipalities at risk of depopulation. On the other hand, the development of this preliminary work would require its application to other regions affected by depopulation in the Valencian Community and other parts of Spain to confirm the validity of the methodology used and the validity of the results obtained.

Finally, while the study focused on retail food sales activities, as well as bars and restaurants, it was also noted that the flow of non-resident visitors (vacationers) has an impact on other axes of local activity. Thus, the effect extends to certain specialized food businesses with recognized quality products linked to the municipality, as well as other products that would fall under the artisan products category (local specialties, "zero-kilometer" commerce, etc.). Although this effect is still considered small in terms of business turnover, it is relevant in that it appeals to the local origin as an element that guarantees the quality of the product; which, even indirectly, can improve the local population's perception of their own territory, fostering greater attachment to the area and reducing migration flows abroad, thus mitigating the risk of depopulation.

In conclusion, through the use of in-depth interviews, this first study has determined that tourism activity (considered in the heterodox

terms defined earlier) may have a greater weight than traditionally attributed in the case of certain small rural municipalities. This new measurement could allow some of these towns to be incorporated into the registry of tourist municipalities of the Valencian Community (in any of its three categories), with the potential advantages this could bring for their future economic development (greater visibility, and thus an increase in the number of visitors and associated economic activities, the possibility of benefiting from territorial development policies in the tourism sector, etc.). All of this would, in the medium and long term, increase the chances of anchoring the population to the territory, ultimately reducing the depopulation risk in these regions.

6. Bibliography

- [1] Alamá-Sabater, L.; Budí, V.; Roig-Tierno, N. y García-Alvarez-Coque, J.M (2021): "Drivers of depopulation and spatial interdependence in a regional context." *Cities*, 114, <https://doi.org/10.1016/j.cities.2021.103217>
- [2] Biehl, D., (ed.) (1986): "The contribution of infraestructura to regional development", Final Report of The Infrastructure Study Group, Área de Política Regional, Comisión de la Comunidades Europeas, Partes 1 y 2, Luxemburgo.
- [3] Biehl, D. (1988): "Infraestructuras y Desarrollo Regional", *Papeles de Economía Española*, 35, págs. 293-310.
- [4] Budí, V. y Alamá-Sabater, L. (2022): "Economía rural, mercado de trabajo y despoblación: efectos derivados de un tamaño de mercado reducido". *Revista de treball, economia i societat*, 104, febrero.
- [5] Carrillo, (2002): "Los turismos genéricos con base a la naturaleza. Su ejemplificación en el territorio andaluz", III Encuentro de Profesores de Formación Turística Universitaria: Madrid, 14 y 15 diciembre 2001, Madrid, Anestur, Federación Española de Turismo.
- [6] Cánoves, G. y Villarino, M. (1997): "El turismo rural en Cataluña y Galicia, una alternativa o complemento de la explotación agraria familiar", en *Los turismos de interior: el retorno a la tradición viajera* / coord. por Manuel Valenzuela Rubio, ISBN 84-7477-652-X, págs. 353-368
- [7] Gibbert, M., Ruigrok, W. y Wicki, B. (2008): "What passes as a rigorous case study?". *Strategic Management Journal*, 29: 1465-1474. <https://doi.org/10.1002/smj.722>
- [8] Gupta, A. y Guillén, M.F. (2008). *Developing, Testing, and Validating Theory with Comparative Case Studies*. Pennsylvania, The Wharton School.
- [9] Ivars, J.A. (2000). "Turismo y espacios rurales: conceptos, filosofía y realidades", *Investigaciones Geográficas*, 23, 59-88.
- [10] Jennings, G.R. (2005). *Interviewing: A Focus on Qualitative Techniques*. In B. W. Ritchie, P. Burns & C. Palmer (Eds.), *Tourism Research Methods* (pp. 99-117). CABL.

- [11] Jiménez, M., Ruiz, J. y Peña, A. (2014). “Incidencia de las zonas rurales sobre las posibles tipologías de turismo rural: el caso de Andalucía”. *Investigaciones regionales*, 28, 101-123.
- [12] Maroto Martos, J.C. y Pinos Navarrete, A. (2019). ¿El turismo rural freno de la despoblación? El caso del sur de España. <https://doi.org/10.1285/i26113775n3p327> en *Despoblación y transformaciones sociodemográficas de los territorios rurales: los casos de España, Italia y Francia – 2019*, edited by Eugenio Cejudo, Francisco Navarro (Perspectives on rural development, 3 / 2019).
- [13] Navarro Valverde, F. A., Capote Lama, A., Porcel Rodríguez, L., & Cejudo García, E. (2025). Propuestas para afrontar la despoblación desde lo local y la relevancia de los mecanismos de desarrollo neo-endógeno: el caso de Andalucía (España). *Boletín De La Asociación De Geógrafos Españoles*, (103). <https://doi.org/10.21138/bage.3590>
- [14] Ozturk, A. B., Ozer, O., Çaliskan, U., Okumus, F., Kar, M., & Bilim, Y. (2015). “The relationship between local residents’ perceptions of tourism and their happiness: A case of Kusadasi, Turkey”. *Tourism Review*, 70(3), 232–242. <https://doi.org/10.1108/tr-09-2014-0053>
- [15] Portillo, M., Ortiz, P. y Morales, F. (2017). “Fraude fiscal, turismo y economía sumergida en España. Un análisis por CCAA”. *Revista de estudios regionales* n° 108, 101-123.
- [16] Riyanto et al., (2023). “The effect of community involvement and perceived impact on residents’ overall well-being: Evidence in Malang marine tourism”. *Cogent Business & Management* 10. <https://doi.org/10.1080/23311975.2023.2270800>
- [17] Sánchez, A., y Sánchez, F. (2018): “Impacto del turismo rural sobre el empleo en España: una aproximación a escala provincial”. *Cuadernos de Desarrollo Rural*, 15(82), 1-19. <https://www.doi.org/10.11144/Javeriana.cdr15-82.itre>
- [18] Soret, P. (1999): “Turismo rural y de naturaleza”. en F. Bayón (dir), 50 años del turismo español: un análisis histórico y estructural. Madrid: Secretaría de Estado de Comercio, Turismo y Pequeña y Mediana Empresa, Centro de Estudios Ramón Areces.
- [19] Valero, J. (2020): “Metodologías cualitativas: la entrevista en profundidad para la investigación en geografía de la población”, en *Población y territorio, España tras la crisis de 2008*, Sempere-Souvannavong, et. al. (eds.).
- [20] Vázquez C y Martín F. (2011), Problemas de sostenibilidad del turismo rural en España. *Revista Anales de Geografía de la Universidad Complutense*. 31(1), pp. 171-194. https://doi.org/10.5209/rev_AGUC.2011.v31.n1.8
- [21] Vera, J. F. (coord.) (2013): *Análisis territorial del turismo y planificación de destinos turísticos*, Valencia, Tirant Humanidades.

Overview and Drivers of Executive Pay in Emerging Markets Evidence from Chile

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Abstract

Research on executive compensation has been mainly developed in advanced economies. Therefore, providing evidence from emerging economies is relevant, as these economies often exhibit particular characteristics, such as a high concentration of ownership. This study employs an empirical approach to identify performance variables and their effects on executive team compensation. The sample includes 34 non-financial firms from 2005 to 2022. Among the most relevant findings, it is noted that regulations are general and lack the detail needed for stakeholders to make informed decisions. Compensation is delivered in different currencies, meaning the financial literacy of the reader becomes a barrier. Female participation on boards has increased in the last five years—still limited, but progress has been made, as with the presence of independent directors. It was found that financial performance, specifically Return on Assets (ROA), is the main determinant of executive pay. This supports the view of compensation contracts as a mechanism to align the interests of principals and agents.

Keywords: Executive compensation, emerging economy, agency theory, pay for performance.

1. Introduction

The literature on executive compensation has developed around the search for determinants that explain pay levels. This remains an unresolved issue and is often described as a puzzle. Various theories have been proposed, including those related to corporate performance (Jensen & Meckling, 1976), sources of power (Finkelstein, 1992), and exogenous factors (Bizjak et al., 2022; Wang et al., 2021; Gibbons & Murphy, 1990), in an effort to explain the high levels of executive compensation and their determinants.

The most extensively studied approach is the agency problem, which may cause misalignments within organizations regarding incentives, aiming to align the interests of principals and agents—a concern raised in corporate governance studies since Jensen and Meckling (1976). Shleifer and Vishny (1997) present agency problems as a core aspect of the contractual view of the firm. Coase (1937) suggests that principals should have the right to control their agents' work, with this control being the defining feature of the relationship. The agency problem is primarily based on the separation between ownership and management, resulting in conflicts between control and ownership.

Studies on executive compensation theories have mostly been conducted in developed economies (Bouteska et al., 2024; Pei, 2024; Hu & Xie, 2024; Keller & Olney, 2021; Morse et al., 2011; Beck et al., 2020; Core et al., 1999), with very limited evidence from emerging markets. Most research in emerging markets has focused on Asian countries. Oehmichen (2018) summarizes the literature on Asian Emerging Markets (AEM), noting their rapidly evolving institutional environments, which make corporate governance in these regions particularly interesting.

Emerging markets offer a unique but underdeveloped source of evidence. In Brazil, studies suggest a high concentration of ownership and control. Less than 4% of Brazilian firms follow good governance practices, yet those that do show significantly higher asset performance (Da Silva & Leal, 2005). Regulatory reforms in emerging economies have also been of interest. Ding et al. (2010) found that prior to implementing new corporate laws, supervisory boards did not

influence executive compensation, but their role became significant afterward. Board size and meeting frequency affect total executive compensation and pay-for-performance sensitivity.

Investor protection and financial market regulation are deeply embedded in each country's legal framework and legal origins (La Porta et al., 1998, 2000). National legislation may play a key role in simplifying conglomerate structures, increasing transparency, and reducing the risk of resource expropriation from minority shareholders (Lefort & Walker, 2000).

In this context, studying Chile as an emerging economy is relevant due to the limited existing evidence and the country's sustained economic growth, political stability, and solid financial system (Vallina-Hernández et al., 2022), which contrasts with the instability found in some Asian emerging markets.

In Chile's emerging market, a high concentration of ownership exists (Vallina-Hernández et al., 2022; Espinoza, 2009). Sources of power, such as ownership, may be relevant, as firms are often run by relatives of the founders, raising concerns about the managerial competence of executives.

Additionally, some Chilean firms listed on the IPSA index have high market capitalization—comparable to major U.S. firms. According to *Forbes Global 2000* (2019), eight Chilean firms were included, with Falabella ranked 695th. Falabella can be compared to large U.S. retail corporations, indicating the international relevance of some Chilean companies. However, information on executive compensation in emerging markets remains difficult to access, particularly in firms with large shareholders (Fan et al., 2011).

The main objectives of this research are to analyze and provide evidence on the characteristics of the executive compensation system in Chile's emerging market and to address the following research questions:

- What are the characteristics of the executive compensation system in Chile's emerging market?
- Is executive compensation influenced by corporate performance?

The structure of this paper is as follows: introduction, literature review, sample, sample analysis, hypotheses, empirical results, discussion, and conclusions.

2. Theoretical Framework

Agency theory suggests the existence of a contractual relationship between company owners and managers (Lundberg, 2022). When the agency contract is executed by shareholders, executives exert effort to maximize the company's performance and provide shareholders with a stable flow of dividends (Jensen & Meckling, 1976). Research on executive compensation has been developed mainly in developed economies (Hu & Xie, 2024; Kayani & Ganm, 2022; Adu et al., 2022; Morse et al., 2011). Therefore, there is very limited evidence from emerging economies. The importance of developing evidence from markets with different conditions has been a less explored line of research (Kato & Kubo, 2006).

On the other hand, managerial power theory has been the least developed in the literature (Li et al., 2024; Hlaing & Stapleton, 2022; Chiu et al., 2016; Grabke-Rundell & Gómez-Mejía, 2002). Executive power within companies could be related to the ability to manipulate compensation contracts, many of which are not publicly disclosed and may change over time. Chief Executive Officers (CEOs) with greater power within the firm may exert pressure to obtain higher compensation (Morse et al., 2011). CEO pay in companies is the result of a negotiation between the executive and the company's board of directors, through which the forces of supply and demand operating in the labor market take concrete form (Shaw, 2006).

In emerging countries, changes in governance regulatory systems have garnered interest from researchers due to their relevance in these economies. According to Ding et al. (2010), it is important to study changes in corporate law and examine whether they improve board monitoring of executive compensation. The authors found evidence that before the new corporate law, supervisory boards did not influence executive compensation, although their role became significant afterwards. Both board size and meeting frequency affect

total executive compensation, and the size of the supervisory board also influences pay-performance sensitivity.

Ownership concentration and conglomerates have been studied around the world (Arora & Singh, 2023). La Porta et al. (1999) suggest that ownership concentration is a consequence of poor legal protection for shareholders. In countries with weak shareholder protection, even large firms tend to have controlling shareholders.

In Latin American emerging markets, Gallego and Larraín (2012) studied CEO compensation and its relationship between majority shareholders and company managers. Among their findings, they highlight that family business ownership leads to higher CEO remuneration. Emerging markets often have companies with high ownership concentration. For example, family businesses in Turkey contribute over 90% to the country's economy. Therefore, family firms are exposed to a type II agency problem, where the main conflict is between the controlling shareholder and minority shareholders. It has been found that family firms reduce the effectiveness of independent directors in monitoring income management (Adigüzel, 2013).

In Brazil's economy, evidence suggests a high degree of ownership and control concentration. Results indicate that fewer than 4% of Brazilian firms follow good corporate governance practices and that firms with better governance perform significantly better in terms of return on assets (Da Silva & Leal, 2005). In Chile's emerging market, a similar phenomenon of high family ownership concentration also exists (Majluf et al., 1998; Lefort & Walker, 2000; Espinoza, 2009).

Thus, characterizing compensation systems in emerging countries provides an opportunity to understand their context, payment structures, and legislation, given their distinguishing features compared to developed countries. In recent years, executive compensation has gained great importance in the business and financial world globally (Urzúa, F., 2009). Particularly in emerging markets such as Chile, there has been growing concern regarding the design and implementation of executive compensation systems.

In the Chilean market, executive compensation systems have been relatively conservative compared to other emerging markets. This is partly due to Chilean business culture, which tends to value

stability and continuity—reflected in the compensation systems used. Generally, executive compensation systems in Chile fall into two main categories: fixed and variable compensation. Fixed compensation includes base salary, social benefits, and other components agreed upon in advance between the company and the executive.

Meanwhile, variable compensation is divided into three main components: bonuses, stock options, and equity participation plans (Berman et al., 2013). Bonuses are the most common form of variable compensation in Chile and are granted based on previously agreed-upon objectives between the company and the executive. Stock options are less common in the Chilean market, as companies are usually reluctant to dilute their capital. Lastly, equity participation plans are also uncommon in Chile, although some companies have begun implementing them in recent years.

In terms of compensation system structure, there is a trend in Chile toward simplifying and making objective definitions and performance evaluations more transparent. Companies also tend to set upper limits for variable compensation and establish a proportion between fixed and variable pay that aligns with their specific needs. Thus, executive compensation systems in Chile are characterized by conservatism and a focus on company stability and continuity. Nevertheless, there has been some progress in implementing more flexible and performance-oriented systems.

It is important to note that while executive compensation systems in Chile have certain strengths, there are also weaknesses and challenges to consider. First, one observed weakness is the lack of transparency in defining objectives and evaluating executive performance (Bravo, 2020). This can lead to mistrust and frustration among employees and shareholders, as compensation decisions may not be clearly understood. Second, a misalignment between executive interests and shareholder interests can be another weakness. In some cases, executive goals may not be clearly tied to the company's performance in terms of value creation for shareholders.

Finally, a major challenge for executive compensation systems in Chile is ensuring fairness and justice in reward allocation. It is crucial that compensation systems are perceived as fair by all employees and shareholders to avoid conflicts and promote executive motivation

and commitment. In summary, executive compensation systems in the Chilean market face certain weaknesses and challenges that must be addressed to ensure their effectiveness and alignment with shareholder and overall corporate interests. Transparency, alignment, flexibility, and fairness are key elements to consider in the design and implementation of these systems.

3. Database and Method

3.1. Database

Regarding the database to be analyzed, it is important to highlight that it is novel, as it was manually compiled from the annual reports of the companies. These reports were downloaded from the Financial Market Commission (CMF), and the section on key executives and the board of directors was reviewed to extract each piece of data. Annual reports are submitted by companies to the CMF, the regulatory body whose main objectives include ensuring the proper functioning, development, and stability of the financial market, as well as ensuring that individuals or entities under its supervision comply with the laws, regulations, statutes, and other applicable provisions.

3.2. Data Collection

A total of 545 annual reports from 34 non-financial companies were reviewed. These companies were listed on the Selective Stock Price Index (IPSA), which includes the most actively traded companies in the country prior to changes in its composition. The sample period covers the years 2005 to 2022. This period was selected based on data availability, and it also includes significant economic and pandemic-related shocks that impacted various industries. The remaining financial information of the companies was extracted from the Refinitiv Eikon database.

3.3. Analyzed Companies

Figure 1 below details the companies included in the analyzed sample and the different industries to which they belong.

Figure 1: Companies in the Sample by Industry.

Materials Industry	Industrial Services
Cap SA	Besalco SA
Empresas CMPC SA	Compañía Sud Americana de Vapores SA
Masisa SA	LATAM Airlines Group SA
Sociedad Química y Minera de Chile SA	SalfaCorp SA
Consumer Industry	Sociedad Matriz SAAM SA
Cencosud SA	Properties
Coca Cola Embonor SA	Parque Arauco SA
Compañía Cervecerías Unidas SA	Technology Industry
Embotelladora Andina SA	Empresa Nacional de Telecomunicaciones SA
Empresas La Polar SA	Sonda SA
Forus SA	Services Industry
Ripley Corp SA	AES Gener SA
SACI Falabella	Aguas Andinas SA
Vina Concha y Toro SA	Inversiones Aguas Metropolitanas SA
Sigdo Koppers SA	Colbun SA
Energy Industry	Enel Americas SA
Antarchile SA	Enel Chile SA
Empresas Copec SA	Enel Generación Chile SA
Financial Industry	Engie Energía Chile SA
Inversiones la Construcción SA	
Sociedad de Inversiones Oro Blanco SA	

4. Analysis of the Sample and Results

First, a descriptive analysis was carried out on the executive compensation system of the companies and their boards. For this

analysis, the sample of 34 companies reviewed over a span of 18 years was used. Additionally, an analysis of the regulations and frameworks governing the companies will be conducted in order to understand how they provide their public information.

4.1. Analysis of the Executive Team

The executive team of the companies is defined as: “any individual who has the ability to determine the objectives, plan, direct, or control the upper management of business operations or the strategic policy of the entity, either alone or together with others,” according to Law 18045.

Next, a descriptive statistical analysis of the compensation system of the executive team from the 34 companies will be presented. The information obtained is shown in Table 1:

Table 1: Descriptive Statistics of the Executive Compensation of the Companies.

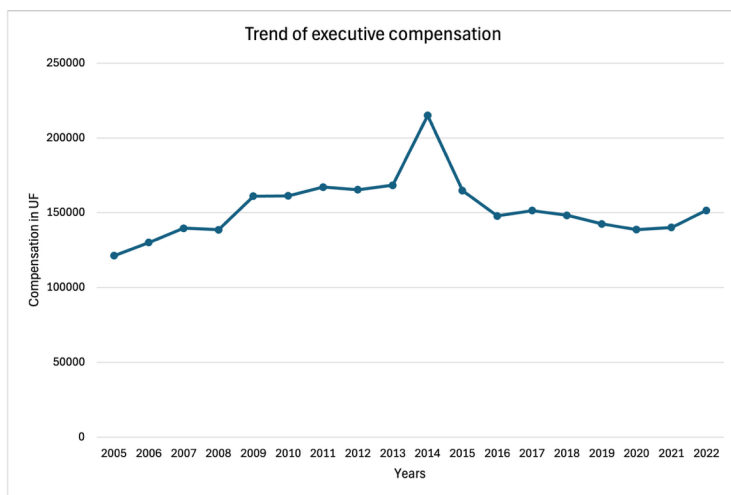
Variable	Obs.	Average	Std. Dev.	Min.	Max.
Total Compensation Executive Team (MM CLP)	545	3804	3991	33	28445
Number of Executive Team Members	545	23	37	1	246

Number of Executive Team Members

Source: Own elaboration.

The companies provide the total compensation amount for the executive team of each company (including the CEO, CFO, among others), who are responsible for making the key decisions.

To analyze the trend in average executive compensation, the compensation amounts were converted into Unidad de Fomento (UF) (the Unidad de Fomento is a system used to express adjustability, i.e., the updated value of a currency, depending on inflation) in order to compare the amounts across years. This is represented in Figure n°2.

Figure 2: Average Compensation of Key Executives.

Sources: Own elaboration. Amounts expressed in UF of the year.

In Figure 2, it can be observed that between the years 2005 and 2022, the compensation amounts for the executive team increased each year, including during the 2018 subprime crisis and the economic slowdown due to the 2020 pandemic. The average annual compensation amount for the entire period was 152978 UF.

The year with the highest compensation amount was 2014, with an annual average of 215037 UF. From 2015 onwards, a significant decrease can be seen, and in the last 8 years, compensations have remained at similar levels. Therefore, it appears that companies have shown a trend toward moderating the amounts of executive compensation over time.

A more detailed analysis of the characteristics of the companies was then conducted. This is represented in Table 2, where the executive compensation details (extracted from the annual reports) by industry are shown, along with some company characteristics.

Table 2: Company Characteristics by Industry.

Industry	Number of Companies	Average Compensation (Million CLP)	Average Total Assets (Million CLP)	Average ROA (%)	Average Returns (%)
Materials	4	4761	5877852380	4.6	18.5
Consumer	10	4812	3036256073145	6.0	11.8
Energy	2	1197	19640649291	4.5	7.9
Financial	2	904	3731482948672	4.7	21.4
Industrial	5	3367	363182636382	3.5	12.6
Properties	1	3453	1645628049938	4.3	19.7
Technology	2	7107	1843305880371	5.9	4.6
Services	8	2664	1607484485227	5.0	9.2
Average				4.8	13.2

Source: Own elaboration.

From the previous table, it is highlighted that the average returns are 13.2%, and the average ROA is 4.8% at the index level. The industries with the greatest representation in the sample are: consumer, services, and industrial.

4.2. Board of Directors Analysis

According to law 18046, in Article 31 it is stated that the management of the corporation must be exercised by a board of directors elected by the shareholders' meeting. Regarding their compensation, Article 33 states that: "The bylaws must determine whether or not the directors will be remunerated for their functions and, if so, the amount of the remuneration will be set annually by the ordinary shareholders' meeting. The annual report submitted by the open joint-stock companies to the ordinary shareholders' meeting must include all remuneration received by the directors from the company during the respective period, including those derived from functions or positions other than their directorship, or for concepts such as representation expenses, travel allowances, royalties, and, in general, any other stipend. These special remunerations must be presented in detail and separately in the report, with those that are not monetary being valued." During the review of the companies' annual reports, available data regarding the compensation of the board of directors was extracted, which is analyzed in the following section (see Table. 3).

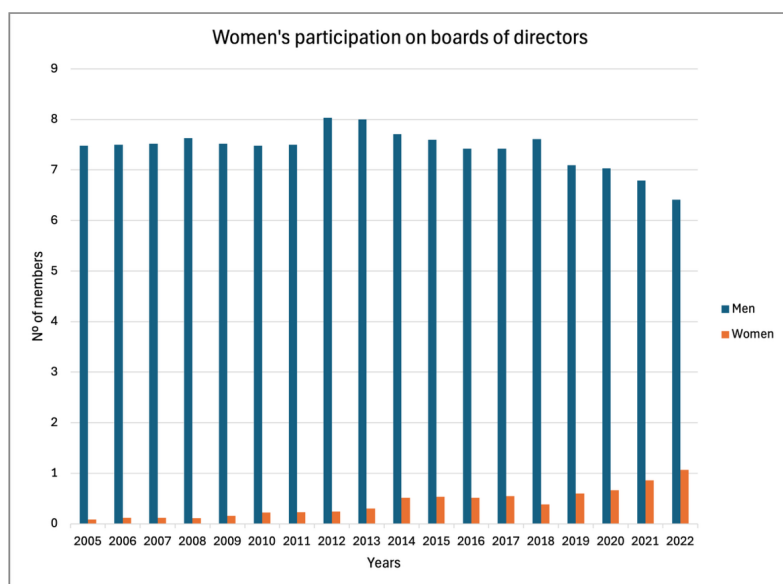
Table 3: Statistical summary of board of directors' information.

Variable	Obs.	Average	Desv. Est.	Min.	Max.
Board Size	510	7.84	1.49	3	14
Number of men on the board	510	7.42	1.54	3	14
Number of women on the board	510	0.42	0.69	0	5
Number of independent directors	510	0.77	1.12	0	7
Board compensation (MM CLP)	510	635	615	1.42	6038

Source: Own elaboration

The compensation amounts for the board of directors have an average of MM\$635 in the sample. The average size of the boards in the companies is 7.8 people.

Among the directors, there is a clear gender bias, with males being predominant in the boards, comprising 94.7% of the total members. The participation of women in the boards is minimal, though this has changed in recent years. Boards have begun a process of gender diversity, gaining more momentum in recent years (see Figure 3).

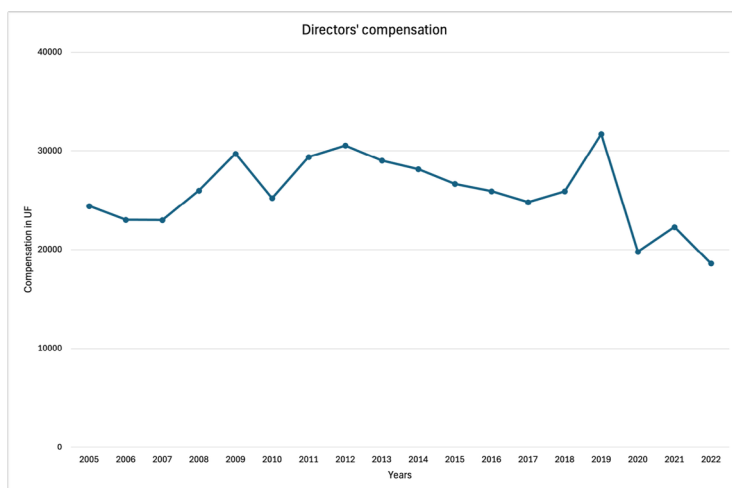
Figure 3: Inclusion of Women in the Boards of Directors.

Source: Own elaboration

In Figure 3, it can be observed that since 2009, there has been a more active participation of women in boards of directors. This participation has steadily increased over the years, as shown. While the participation of women is still in its early stages (close to 5% of the total board members), their progress in recent years is noteworthy.

Regarding board compensation, these amounts are determined in the ordinary shareholders' meeting. Therefore, analyzing its evolution over time is interesting because shareholders approve the board's compensation amounts, and with a high concentration of ownership, it is the majority shareholders who have the most voting power. To observe the trend, we examine the trend over time of average board compensation amounts, which will be analyzed in UF (see Figure 4).

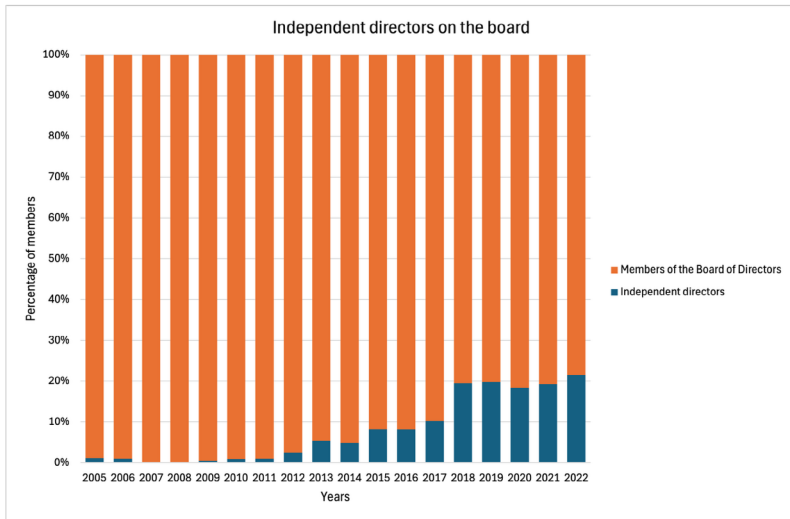
Figure 4: Trend of Board Compensation.



Source: Own elaboration

In Figure 4, it can be seen that the trend of compensation amounts has been stable throughout the studied period, except for the economic crisis periods of 2008-2009 and the social crisis and pandemic of 2019-2020.

Independent directors play an important role within boards, as they protect the interests and wealth of minority shareholders, contributing through their monitoring role within companies. Figure 5 shows the trend over time of independent directors.

Figure 5: Trend of Independent Directors on the Board.

Source: Own elaboration

On average, companies have 0.7 independent directors during the entire period, with a positive increasing trend since 2010. A significant increase in independent directors started in 2018, reaching 20% of the total. This trend shift may be a result of the modification of Article 50 bis of Law 18046 in 2009, which incorporated the requirement that public companies must appoint at least one independent director and a board committee when meeting the market value requirements set by this article.

4.3. Development of Hypotheses

Considering agency theory, we will study the impact of company performance (in financial and market terms) on the compensation of top executives. As mentioned previously, one of the novel aspects of this study is the use of a new data set from an emerging market, which is often difficult to access regarding executive compensation information. Additionally, these markets feature a high concentration of ownership. This research contributes to the literature by providing evidence from the agency theory perspective, which has provided inconclusive findings in this area. To this end, the following hypotheses will be tested:

H1: The financial performance of the company is positively associated with the level of executive compensation.

H2: The market performance of the company is positively associated with the level of executive compensation.

It is expected that the greater the level of effort from the executive team, the better the company's performance will be, measured in financial terms and market value. This effort would be rewarded with a higher level of compensation.

4.4. Methodology and Results of the Empirical Research

To address the research question regarding whether executives are compensated for their management skills (corporate performance), the following estimation model was considered. The model developed to test hypotheses H1 and H2 is an adaptation of Ozkan's (2011) work and is as follows:

Equation 1:

$$WTMT_{it} = \beta_0 + \beta_1 PERFIN_{it} + \beta_2 PERMARK_{it} + \beta_3 BOARD_{it} + \beta_4 INDBOARD_{it} + \beta_5 WBOARD_{it} + controls + \varepsilon_{it}$$

Where:

- WTMT is the total compensation of the executive team for company i in year t .
- PERFIN is the ROA profitability index for company i in year t .
- PERMARK is the stock return index for company i in year t .
- BOARD is the board size of company i in year t .
- INDBOARD is the number of independent directors on the board of company i in year t .
- WBOARD is the number of women on the board of company i in year t .
- Controls are control variables, including size and debt.
- ε is the error term.

From the perspective of agency theory, where compensation contracts are a mechanism to align the interests of the principal and

agent, the results of our research suggest that corporate performance variables have a significant impact on the level of executive compensation. The results of the empirical model used are shown in Table 4.

Table 4: Regression of Executive Compensation and Corporate Performance

Variables	M1	M2	M3
ROA	2,527***		3,087***
Returns	(892.5)		(899.7)
Board Size		-251.0*	-371.5**
Independent Directors		(152.1)	(159.5)
Women on the Board	11,055***	10,500***	10,895***
Size	(4,087)	(3,968)	(4,046)
Debt	-16,504	-17,586*	-17,512*
Constant	(10,339)	(10,149)	(10,258)
ROA	5,342	3,511	5,430
Returns	(10,240)	(10,213)	(10,273)
Board Size	14,865***	16,898***	14,062***
Independent Directors	(5,422)	(5,105)	(5,400)
Women on the Board	223,601***	174,233***	225,169***
Size	(41,716)	(37,165)	(41,838)
Debt	-213,121***	-196,269***	-204,929***
	(54,184)	(54,831)	(54,155)
Observations	541	541	541
Year Fixed Effect	Yes	Yes	Yes
R-squared	0.123	0.117	0.131

The model eq.1: Executive Compensation and Corporate Performance, dependent variable: Executive Compensation. Standard errors are in parentheses, with year fixed effects.

Independent Variables in the Regressions:

ROA (Return on Assets), Returns (company returns), Board Size (number of board members), Independent Directors (number of independent directors), Women on the Board (number of women on the board), Size = log (total assets), Debt = debt-to-equity ratio. The time period is from 2005 to 2022. Significance notation: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Findings:

One key finding is that the ROA corporate performance variable is significant (0.01) with a positive sign (when the performance variable is considered separately in M1). Later, when all variables are considered together (M3), the ROA variable remains significant and maintains its positive sign. This suggests that higher financial performance, as measured by ROA, is associated with higher executive compensation. This result supports our hypothesis H1, which proposes that greater executive effort is rewarded with higher pay.

On the other hand, when considering the market performance variable (returns), regression M2 shows a weak negative significance ($p < 0.1$). This result suggests the rejection of hypothesis H2. It implies that in the Chilean market, executive compensation contracts are more strongly tied to financial performance than market performance.

The corporate governance variable, board size, is significant ($p < 0.01$) with a positive sign, indicating that larger boards are associated with higher executive compensation. This could be because companies with more assets have a higher number of shareholder representatives on the board, which translates into higher pay for the executives managing those assets.

The variables of independent directors and women on the board are not significant in the model, so there is no evidence that these corporate governance characteristics influence executive compensation levels. This finding could indicate the absence of agency problem type 1, and perhaps an agency problem type 2 exists, where the conflict is between different types of shareholders (controlling and minority shareholders). Agency problem type 2 is related to countries with weak investor protection and markets with high ownership concentration, such as Chile.

Finally, company size and debt ratio were controlled for in the model. Of these variables, size ($p < 0.01$) and debt ($p < 0.01$) are significant with a positive sign, aligning with previous evidence. This suggests that larger company size and higher debt levels are associated with higher executive pay.

5. Discussion

This article focuses on answering the following research questions:

- What are the characteristics of the executive compensation system in the emerging market of Chile?
- Is the level of executive compensation influenced by corporate performance?

In emerging markets with large shareholders, access to executive compensation data is limited (Fan et al., 2011), which is why a new database was developed to provide evidence on the compensation structure in the Chilean market. Executive compensation systems in Chile have been a topic of discussion and debate in recent years, both among employees, shareholders, and experts in business management and finance.

Key findings include that during the subprime economic crisis period, executive compensation did not decrease, nor did it during the 2019 pandemic period. This raises questions about whether this is due to an effort to retain executive talent or possibly weak corporate governance. While regulations in the financial market in Chile require companies to report total executive compensation, the reported amounts are aggregated and do not disclose details by role. This situation reveals that, on one hand, some argue that executive compensation systems in Chile are too conservative and not aligned with global trends in remuneration. According to this perspective, Chilean companies may be losing talent and leadership capability by not offering more attractive and competitive compensation packages.

Another point of discussion concerns transparency and fairness in reward allocation. Some argue that Chilean companies should be more transparent in defining objectives and assessing performance to avoid conflicts and demotivation among employees and shareholders (Makdisse et al., 2022).

In conclusion, both the analysis and the database created offer the possibility of further exploration into executive compensation systems in the Chilean emerging market. Different theoretical approaches such as managerial power theory (Finkelstein, 1992) and relative performance pay theory (Gibbons & Murphy, 1990) could be applied to answer new research questions related to executive compensation.

6. Conclusions

A characterization of the executive compensation system has been provided through a detailed descriptive analysis of executive compensation, board compensation, and committee compensation. Additionally, an empirical model offers evidence of the corporate performance variables that influence executive compensation in the Chilean emerging market, where access to compensation data is limited.

Firstly, the Chilean executive compensation market is characterized by relatively general regulations on declared compensation. The amounts are reported only in aggregate, with no detailed breakdown for roles like CEO or CFO. The regulations specify that total compensation must be disclosed, but do not clarify reporting in terms of currency (e.g., UF, dollars, or CLP) or units (e.g., millions, thousands, etc.), creating potential transparency barriers.

Secondly, only 28% of companies report a breakdown of their compensation structure (fixed and variable separately). Furthermore, a small 3.4% of companies report compensation provided in the form of stock options to executives.

Thirdly, when examining executive compensation during the economic crisis of 2008-2009 and the 2019-2020 pandemic, compensation remained unchanged despite deteriorating macroeconomic indicators (e.g., economic growth slowdown, rising unemployment). This raises questions about whether the reasons could be related to retaining executive talent or weak corporate governance.

Additionally, there has been a gradual increase in the inclusion of women on boards, as well as an increase in the number of independent directors since 2012. Independent directors safeguard minority investors' interests.

In terms of variables influencing compensation, financial performance (ROA) is significant and positively impacts executive pay. This suggests that higher executive effort leads to higher pay, and managing larger assets and higher debt levels is similarly rewarded. These findings align with agency theory, using compensation as a mechanism to align the principal-agent expectations.

Limitations and Future Research Directions

Regarding limitations, the sample size should be expanded to better understand the phenomenon from a more generalized perspective. It would also be beneficial to include data from other emerging countries for comparative purposes, helping to better understand executive compensation systems across different contexts (Harjanti & Farhan, 2022; Ferry et al., 2021; Dias et al., 2020; Sheikh et al., 2017).

As a future research direction, the database created offers the potential for deeper investigation into executive compensation systems in the Chilean emerging market. Different theoretical approaches such as managerial power theory (Finkelstein, 1992) and relative performance pay theory (Gibbons & Murphy, 1990) could help answer new questions related to executive compensation in emerging markets.

7. Bibliography

- [1] Adigüzel H. Corporate governance, family ownership and earnings management: Emerging market evidence. *Accounting and Finance Research*. 2013;2(4):17-33.
- [2] Adu DA, Flynn A, Grey C. Executive compensation and sustainable business practices: The moderating role of sustainability-based compensation. *Business Strategy and the Environment*. 2022 Mar;31(3):698-736.
- [3] Arora, N. and Singh, B. (2023), "Board characteristics, ownership concentration and SME IPO underpricing", *Pacific Accounting Review*, Vol. 35 No. 1, pp. 19-49.
- [4] Beck D, Friedl G, Schäfer P. Executive compensation in Germany. *Journal of Business Economics*. 2020 Jun;90(5):787-824.
- [5] Berman E, Wang CY, Chen CA, Wang X, Lovrich N, Jan CY, Jing Y, Liu W, Gomes R, Sonco JT, Melendez C. Public executive leadership in east and west: An examination of HRM factors in eight countries. *Review of Public Personnel Administration*. 2013 Jun;33(2):164-84.
- [6] Bizjak J, Kalpathy S, Li ZF, Young B. The choice of peers for relative performance evaluation in executive compensation. *Review of Finance*. 2022 Sep 1;26(5):1217-39.
- [7] Bouteska A, Sharif T, Abedin MZ. Executive compensation, risk and performance: evidence from the USA. *Corporate Governance: The International Journal of Business in Society*. 2024 Apr 30;24(4):964-91.
- [8] Bravo RL. Mediation in public healthcare: opportunities for improvement. *Revista Medica de Chile*. 2020 Feb 1;148(2):211-5.
- [9] Coase RH. *Economica*. New Series. 1937 Nov;4(16):386-405.

- [10] Core JE, Holthausen RW, Larcker DE. Corporate governance, chief executive officer compensation, and firm performance. *Journal of financial economics*. 1999 Mar 1;51(3):371-406.
- [11] Chiu HH, Oxelheim L, Wihlborg C, Zhang J. Macroeconomic fluctuations as sources of luck in CEO compensation. *Journal of business ethics*. 2016 Jun;136:371-84.
- [12] da Silva AL, Leal RP. Corporate governance index, firm valuation and performance in Brazil. *Revista Brasileira de Finanças*. 2005;3(1):1-8.
- [13] Dias A, Vieira V, Figlioli B. Tracing the links between executive compensation structure and firm performance: evidence from the Brazilian market. *Corporate Governance: The International Journal of Business in Society*. 2020 Nov 16;20(7):1393-408.
- [14] Ding S, Wu Z, Li Y, Jia C. Executive compensation, supervisory board, and China's governance reform: a legal approach perspective. *Review of Quantitative Finance and Accounting*. 2010 Nov;35:445-71.
- [15] Méndez CE. Estructura de propiedad y desempeño de la firma: el caso chileno. *Academia. Revista Latinoamericana de Administración*. 2009(43):41-62.
- [16] Fan JP, Wei KJ, Xu X. Corporate finance and governance in emerging markets: A selective review and an agenda for future research. *Journal of Corporate Finance*. 2011 Apr 1;17(2):207-14.
- [17] Ferry L, He G, Yang C. How do executive pay and its gap with employee pay influence corporate performance? Evidence from Thailand tourism listed companies. *Journal of Hospitality and Tourism Insights*. 2023 Jan 20;6(1):362-81.
- [18] Finkelstein S. Power in top management teams: Dimensions, measurement, and validation. *Academy of Management journal*. 1992 Aug 1;35(3):505-38.
- [19] Gallego F, Larrain B. CEO compensation and large shareholders: Evidence from emerging markets. *Journal of Comparative Economics*. 2012 Nov 1;40(4):621-42.
- [20] Gibbons R, Murphy KJ. Relative performance evaluation for chief executive officers. *ILR Review*. 1990 Apr;43(3):30-S.
- [21] Grabke-Rundell A, Gomez-Mejia LR. Power as a determinant of executive compensation. *Human Resource Management Review*. 2002 Mar 1;12(1):3-23.
- [22] Harjanti W, Farhan A. CEO compensation: A brief study from Indonesia. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*. 2022;5(2):13279-88.
- [23] Hu J, Lin X, Xie F. Executive compensation, internal control quality, and corporate social responsibility in China. *Journal of Financial Research*. 2024 Mar;47(1):147-77.
- [24] Hlaing KP, Stapleton A. A Literature Review on the Dual Effect of Corporate Tax Planning and Managerial Power on Executive Compensation Structure. *Accounting Perspectives*. 2022 Jun;21(2):387-423.
- [25] Meckling WH, Jensen MC. Theory of the Firm. Managerial behavior, agency costs and ownership structure. 1976;3(4):305-60.
- [26] Kato T, Kubo K. CEO compensation and firm performance in Japan: Evidence from new panel data on individual CEO pay. *Journal of the Japanese and International Economies*. 2006 Mar 1;20(1):1-9.
- [27] Kayani UN, Gan C. Executive compensation and firm performance relationship. *Review of Pacific Basin financial markets and policies*. 2022 Mar 3;25(01):2250008.

- [28] Keller W, Olney WW. Globalization and executive compensation. *Journal of International Economics*. 2021 Mar 1;129:103408.
- [29] La Porta R, Lopez-de-Silanes F, Shleifer A. Corporate ownership around the world. *The journal of finance*. 1999 Apr;54(2):471-517.
- [30] La Porta R, Lopez-de-Silanes F, Shleifer A, Vishny R. Investor protection and corporate governance. *Journal of financial economics*. 2000 Jan 1;58(1-2):3-27.
- [31] Lefort F, Walker E. Ownership and capital structure of Chilean conglomerates: Facts and hypotheses for governance. *Revista Abante*. 2000;3(1):3-27.
- [32] Li B, Pongtornkulpanich A, Chankoson T. Management Power, Executive Compensation and Corporate Value in Migration Policies. *ALGAE*. 2024 Jan 10:96-116.
- [33] Lundberg J. Agency Theory's "Truth Regime": Reading Danish Pension Funds' Decisions Regarding Shell from the Perspective of Agency Theory. *Sustainability*. 2022 Nov 10;14(22):14801.
- [34] Majluf N. Governance and ownership structure in chilean economic groups.
- [35] Makdisse M, Ramos P, Malheiro D, Katz M, Novoa L, Neto MC, Ferreira JH, Klajner S. Value-based healthcare in Latin America: a survey of 70 healthcare provider organisations from Argentina, Brazil, Chile, Colombia and Mexico. *BMJ open*. 2022 Jun 1;12(6):e058198.
- [36] Morse A, Nanda V, Seru A. Are incentive contracts rigged by powerful CEOs?. *The Journal of Finance*. 2011 Oct;66(5):1779-821.
- [37] Oehmichen J. East meets west—Corporate governance in Asian emerging markets: A literature review and research agenda. *International Business Review*. 2018 Apr 1;27(2):465-80.
- [38] Ozkan N. CEO compensation and firm performance: An empirical investigation of UK panel data. *European Financial Management*. 2011 Mar;17(2):260-85.
- [39] Porta RL, Lopez-de-Silanes F, Shleifer A, Vishny RW. Law and finance. *Journal of political economy*. 1998 Dec;106(6):1113-55.
- [40] Pei J. A Study of Executive Compensation Incentives and Firm Performance. *HBEM [Internet]*. 2024 Jan. 22 [cited 2025 Jun. 13];24:338-43.
- [41] Shaw W. Justice, incentives, and executive compensation. *The ethics of executive compensation*. 2006:87-100.
- [42] Sheikh AU, Khalifa MA, Zerguine A. Compensation of per-energy capacity ratio degradation due to fading in femto-macro environment. In: 2017 International Symposium on Wireless Systems and Networks (ISWSN) 2017 Nov 19 (pp. 1-5). IEEE.
- [43] Shleifer A, Vishny RW. A survey of corporate governance. *The journal of finance*. 1997 Jun;52(2):737-83.
- [44] Urzúa F. Too few dividends? Groups' tunneling through chair and board compensation. *Journal of Corporate Finance*. 2009 Apr 1;15(2):245-56.
- [45] Vallina-Hernández AM, de la Fuente-Mella H, Fuentes-Solís R. Analysis of the internationalization and value chain activities in Chilean enterprises. *Contemporary Economics*. 2022;16(1):88.
- [46] Wang C, Zhang S, Ullah S, Ullah R, Ullah F. Executive compensation and corporate performance of energy companies around the world. *Energy Strategy Reviews*. 2021 Nov 1;38.

Real Estate Digital Intelligence: Home Rental Prices in the Province of Alicante Using Machine Learning

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Abstract

The emergence of Artificial Intelligence (AI) has deeply transformed various sectors, including the real estate industry, where its application improves operational efficiency, personalizes services, and facilitates decision-making through predictive analysis. In this context, the present research aims to develop a methodology for the training, optimization, and interpretation of machine learning models focused on estimating the rental price of multifamily housing in the province of Alicante. To achieve this, a large georeferenced rental price database, cross-sectional and grouped, collected between 2019 and 2024, was used. The proposed methodology covers all phases of the modeling cycle: from data preparation and cleaning, feature engineering, model training and hyperparameter optimization, to performance evaluation and result interpretation. The results show that boosting-based machine learning algorithms offer the best trade-off between predictive performance, generalization capability, and computational efficiency. The interpretability analysis of machine learning models, both global and local, has allowed the identification of the most relevant features in predicting rental prices. Together, the

results demonstrate the potential of AI to support automated property valuation processes and facilitate informed decision-making in complex urban environments.

Keywords: Housing Price, Mass Valuation, Machine Learning, Hyperparameters, Alicante.

1. Introduction

In the last decade, Artificial Intelligence (AI) has emerged with great force, transforming various aspects of people's daily lives, providing innovative and efficient solutions to a wide range of tasks. AI has proven to be versatile and highly useful in applications such as virtual assistants and chatbots, pattern recognition and computer vision, natural language processing for translation or text summarization, recommendation systems, medical diagnostics, autonomous driving, and even weather forecasting.

One of the existing problems with the implementation of AI algorithms is that they do not “explain” how they arrive at a particular result or decision. This is particularly evident in machine learning models developed by private companies, where this information is intentionally hidden as trade secrets to protect intellectual property and/or maintain a competitive edge in the market.

AI has begun to play a significant role in the real estate market, introducing innovations that improve efficiency, personalization, and decision-making for users. Examples of these include real estate platforms that use AI in property search and recommendation, virtual property viewing assistants, predictive market analysis, risk assessment, credit or financial fraud evaluation, among other applications.

In Spain, there is a situation of rising property sales and rental prices, which is causing significant problems in accessing housing, whether for purchase or rent. The increase in prices has occurred unevenly across different areas of Spain, particularly affecting large cities and tourist areas. This has raised concerns about housing accessibility, especially for young people and those with lower incomes. Many circumstances contribute to this price escalation,

such as housing shortages, the impact of tourism and short-term rentals, foreign investments, rising mortgage costs due to interest rate increases, inflation, rising construction material prices, and recent public policies affecting landlords and sellers.

Currently, the general public often has limited knowledge about the real estate market, its dynamics and evolution, and how new technologies can help better understand the issue. For this reason, it is considered necessary to foster a “digital citizenship” that learns to use digital tools responsibly to address their doubts and questions about this topic, thereby promoting greater “digital intelligence” in our society.

In this context, the authors of this research believe that providing quality information to future buyers and renters of properties can efficiently assist in housing searches and user decision-making. Additionally, professionals involved in property sales, real estate appraisers, housing administration technicians, property developers, as well as small and medium-sized investors, can also benefit from this new source of information and technology about the real estate market proposed in this research.

The main objective of this work is to develop a methodology for training and optimizing machine learning algorithms aimed at estimating the rental price of multifamily housing in the province of Alicante. This methodology is implemented in an open-access web application, designed to provide updated information about the residential rental market in large and medium-sized municipalities in the province. The application aims to facilitate access to this data even for users with limited technological skills, promoting an accessible and efficient use of artificial intelligence-based tools for understanding and analyzing the local real estate market.

The automated estimation of housing prices has received growing attention in the scientific literature, driven by the availability of large volumes of structured and georeferenced data, as well as advances in AI techniques. In particular, machine learning algorithms have demonstrated significant potential for capturing complex relationships between multiple variables, overcoming linearity limitations, and offering high levels of performance in predicting real estate prices.

A first widely documented approach involves comparing the predictive behavior of traditional regression models, especially hedonic price models (HPM), with various machine learning algorithms (1). Empirical evidence gathered in numerous studies (2-12) suggests that classic models, while useful for the economic interpretation of price determinants, have lower predictive capacity compared to machine learning algorithms, especially in contexts with high dimensionality and non-linear relationships between variables.

A second approach in the literature focuses on identifying the most suitable machine learning algorithms for predicting property prices in different geographic and temporal contexts (1, 13-17). These studies comparatively evaluate models such as Random Forest (RF), Gradient Boosting (GBR), Extreme Gradient Boosting (XGBoost), LightGBM, Support Vector Machines (SVM), and deep neural networks (DNN), applying metrics such as MAE, RMSE, and R^2 on different data subsets. The results tend to agree on the superiority of boosting-based algorithms, particularly in their ability to model non-linear relationships and handle variable interactions without requiring prior functional specification.

This document is organized as follows. Section 2 describes the materials and methods, detailing the sources used and the generated database. Section 3 presents the results of the training, optimization, and validation process of the machine learning models, along with their interpretation. Section 4 provides a summary of the conclusions.

2. Materials and Method

2.1. Information Sources and Database

The information on property offer prices was extracted from a real estate web portal, collecting asking prices as well as the characteristics of both the properties and the buildings. Monthly downloads were made over six years, from 2019 to 2024. The collected data includes rental asking prices, property characteristics (type, built area, number of bedrooms and bathrooms, etc.), building attributes (elevator, parking space, swimming pool, etc.), and geographical location (geographic coordinates).

After the initial raw data download, a review was conducted to detect inconsistencies and outliers. A missing data analysis was then performed, identifying and discarding properties without price, geographic coordinates, or essential features. Variables with low variability or a high percentage of missing values were also removed. Once this stage was completed, a second cleaning process was carried out to eliminate duplicate properties with identical characteristics.

To model the effect of time, a categorical feature representing the temporal presence of each property in the market was incorporated, identifying the specific quarter in which it was listed. Finally, the information was structured into a pooled cross-section dataset. The multifamily rental property database consists of 59,875 unique properties. The complete temporal data sample includes 101,724 observations, spanning from 2019 to 2024. Table 1 lists the features used in the project, categorized into four groups.

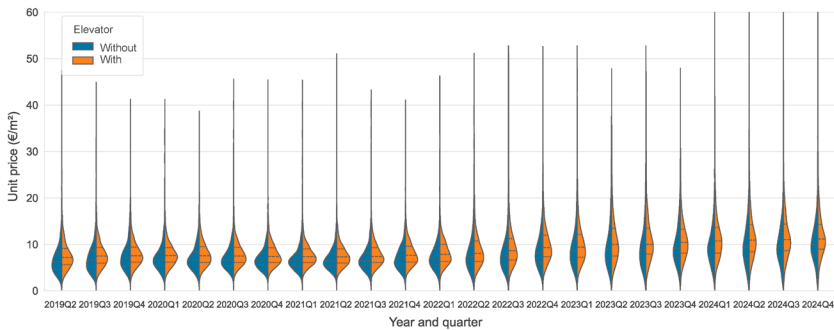
Table 1: Characteristics of the variable set to be used.

Category	Characteristic	Value Type	Description
Dwelling characteristics	Typology	Categorical	Categorical feature identifying the dwelling typology (flat, penthouse, duplex/triplex, studio/loft, and ground floor)
	Area m2	Numerical	Build area of the dwelling (m ²)
	Bedrooms	Numerical	Number of bedrooms in the dwelling
	Bathrooms	Numerical	Number of bathrooms in the dwelling
	Toilets	Numerical	Number of toilets in the dwelling
	Air conditioning	Dichotomous	Air conditioning availability
	Heating	Dichotomous	Heating availability
	New construction	Dichotomous	Indicates whether the dwelling is a new build
Building characteristics	Elevator	Dichotomous	Elevator availability
	Garage	Dichotomous	Parking space availability
	Storage room	Dichotomous	Storage room availability
	Pool	Dichotomous	Swimming pool availability
	Terrace	Dichotomous	Open terrace availability

Category	Characteristic	Value Type	Description
Location characteristics	Longitude	Numerical	Geographic coordinates of the spatial location (in decimal degrees), WGS84 datum
	Latitude		
	Municipality	Categorical	Categorical feature identifying the municipality in which each property is located
Temporal characteristics	Year-Quarter	Categorical	Categorical feature for modeling the time factor (23 quarters, from 2019Q2 to 2024Q4)
Dependent feature	Price	Numerical	The asking rental price of the multi-family dwelling in euros

Figure 1 shows the distribution of unit rental prices based on the presence or absence of an elevator. It can be observed that the price distribution for properties with an elevator is shifted and more stretched toward higher price ranges compared to those without an elevator. Additionally, the price range has widened in recent years (between 2022 and 2024), in contrast to the period from 2019 to 2021, when prices were more concentrated within narrower ranges. The average unit rental price in the province of Alicante has increased from €7.67/m² ($SD=3.94$) in the second quarter of 2019 to €11.70/m² ($SD=5.15$) in the fourth quarter of 2024.

Figure 1: Violin chart showing the distribution of unit prices (€/m²) for rental housing with and without an elevator, according to the quarter of supply.



2.2. Methodology

In this research, various ensemble learning algorithms have been implemented and evaluated with the aim of estimating housing rental prices based on large datasets. The ensemble learning algorithms used include boosting-based methods: Gradient Boosting Regressor (GBR), Extreme Gradient Boosting (XGBM), and Light Gradient Boosting Machine (LGBM); as well as bagging-based methods: Random Forest (RF) and Extra Trees Regressor (ET).

The Python programming language was used, employing the pandas and numpy libraries for data processing. For the implementation of machine learning algorithms, the scikit-learn and scikit-optimize libraries were used, along with lightgbm and xgboost. For plotting, the matplotlib, seaborn, and yellowbrick libraries were employed. For model interpretation, the scikit-learn, shap, and eli5 packages were used.

All the steps typically involved in a standard machine learning workflow were addressed: data collection, preparation and exploratory analysis, preprocessing and feature engineering, model training and hyperparameter optimization, model evaluation and selection, model interpretability, and finally, web deployment and monitoring. A more detailed description of these steps is provided below:

Data Preparation: An exploratory data analysis is performed, followed by a data cleaning and transformation process prior to conducting data mining tasks. This process involves formatting the data (grouping, discretization, binarization), enriching it with information from other sources, identifying and handling outliers and missing values, or transforming variables (standardization, normalization).

Feature Engineering: Techniques are used to extract features from raw data through data mining techniques (feature creation, feature extraction, and feature selection). These techniques enhance the performance of machine learning algorithms. Based on several baseline models, the possibility of encoding categorical variables is evaluated; new features are generated through aggregation, transformation, or combination of existing ones; new features are created to summarize original variables (principal and discriminant component analysis, auto-encoding); and the most relevant features are selected using

recursive selection methods (sequential feature selection, recursive feature elimination).

Training and Model Selection: Multiple candidate models are trained to estimate their predictive power and determine which algorithms perform best. Model selection is based on error metrics (MAE, RMSE, MAPE, etc.), goodness of fit (R^2), or other selection indices that consider both fit and model complexity (BIC and AIC).

Hyperparameter Optimization: This phase aims to improve the model's fit and/or minimize prediction errors. Once the best algorithm(s) have been identified, the impact of hyperparameters is assessed and fine-tuned using cross-validation techniques. A subset of the training data is used to apply a variety of hyperparameter combinations and evaluate their performance on another validation subset.

Model Evaluation: In this phase, the models are evaluated to identify which one performs best in predicting the dependent variable. The potential for overfitting, detected in the previous phase through cross-validation and the use of training and test subsets, is also assessed.

Model Interpretation: Tools are used to identify the most important features in the model using global and local approaches, as well as visual techniques to interpret the predictions. These include Partial Dependence Plots (PDP), Individual Conditional Expectation (ICE) plots, Accumulated Local Effects (ALE) plots, and SHAP (SHapley Additive exPlanations) values, among others.

Model Deployment: In this phase, a web platform is developed to deploy the model into production, allowing predictions to be made based on initial input data.

3. Results

3.1. Model Training and Optimization

The goal of hyperparameter optimization is to improve model fit and minimize prediction errors as much as possible. This process was carried out exclusively on the training partition, which corresponds to 70% of the original dataset. This partition was used in cross-validation

with a three-fold scheme, generating separate subsets: CV-training and CV-validation. All data splits (training and test; and CV-training and CV-validation) were done in order to separate the datasets based on a group identifier, using the “GroupShuffleSplit” method from the scikit-learn library, with the property identifier used as the grouping attribute.

Once the dataset was prepared and the training pipeline defined, each algorithm was trained using two hyperparameter search strategies: random search and Bayesian search, with a maximum of 20 iterations in each case. This limit was chosen due to the computational complexity inherent in some algorithms, such as RF and ET, which have high processing times during this stage.

Table 2 presents the performance results from the training and optimization phase of the machine learning algorithms. Figure 2 shows a box plot with the distribution of the values obtained during cross-validation (CV-training and CV-validation), considering both the random and Bayesian search strategies for each of the evaluated algorithms.

The best results were achieved with the boosting-based algorithms, in the following order: LGBM, GBR, and XGBM. In contrast, the bagging-based algorithms, such as RF and ET, did not achieve competitive results compared to their boosting counterparts during hyperparameter optimization.

Table 2: Hyperparameter tuning results using cross-validation (R^2 values in CV-validation).

Model	Name	Hyperparameter Optimization (CV-validation)		
		Random search	Bayesian search	Best fit
Random Forest Regressor	RF	0.5639 (0.0081)	0.5601 (0.0062)	Random Search
Extra Trees Regressor	ET	0.5384 (0.0031)	0.5285 (0.0011)	Random Search
Gradient Boosting Regressor	GBR	0.5857 (0.0082)	0.6134 (0.0032)	Bayesian Search
Extreme Gradient Boosting	XGBM	0.6099 (0.0059)	0.6000 (0.0061)	Random Search

Model	Name	Hyperparameter Optimization (CV-validation)		
		Random search	Bayesian search	Best fit
Light Gradient Boosting Machine	LGBM	0.6077 (0.0065)	0.6143 (0.0031)	Bayesian Search

Note: R^2 value and standard deviation (SD) in parentheses.

Figure 2: Performance results of hyperparameter tuning using cross-validation with random and Bayesian search strategies (R^2 values for CV-training and CV-validation).

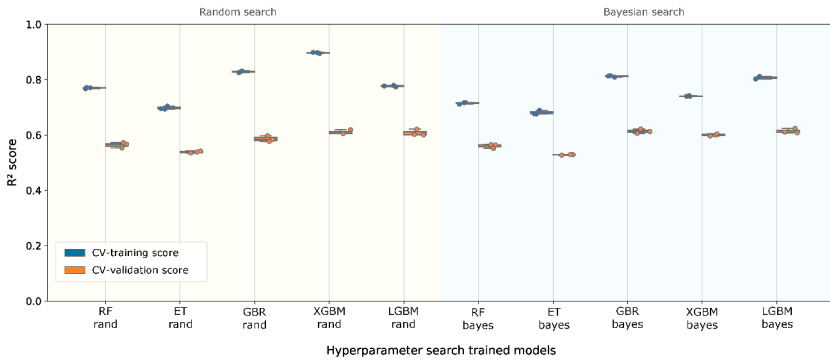
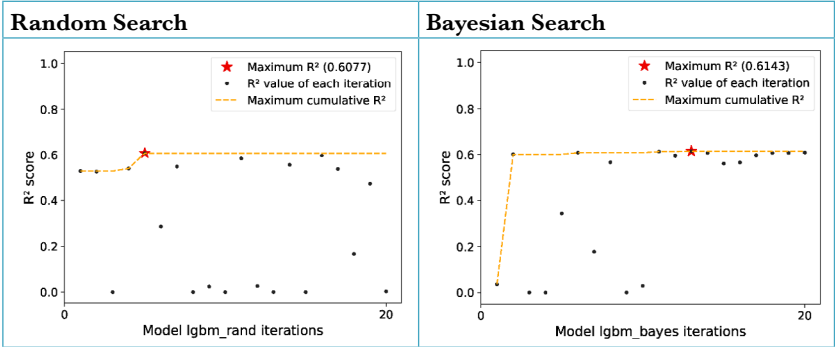


Figure 3 shows the learning curves of hyperparameter search for the LGBM algorithm. The results indicate that neither of the two hyperparameter search strategies demonstrated significantly superior performance over the other. While the Bayesian search required longer processing times, the random search produced a greater number of suboptimal hyperparameter combinations. This highlights the trade-off between processing time and efficiency in generating optimal configurations, an important factor to consider in future developments and applications of the model.

Figure 3: Learning curves for hyperparameter search of the LGBM algorithm.



★ *Maximum R^2* , • *R^2 value for each iteration*, --- *Cumulative maximum R^2* .

3.2. Model Evaluation and Selection

At this stage, the candidate algorithms are trained in order to evaluate their predictive capabilities and determine which models perform best on the test data subset (30% of the original dataset). Model selection is carried out using the error and goodness-of-fit metrics previously described in the methodology section.

Once the best hyperparameters were identified in the previous phase, the corresponding models were trained, and performance metrics were extracted for both the training and test sets. The values presented in the cross-validation column (CV-validation) reflect the performance of the selected models during the prior stage and are included here for comparative and illustrative purposes. The overfitting column was calculated as the percentage difference between performance on the test and training sets, providing an estimate of each algorithm’s generalization capability.

Table 3 presents the performance and overfitting values for the different evaluated algorithms. Among the best-performing models (LGBM, GBR, and XGBM), the XGBM algorithm shows a considerable degree of overfitting (+40.6%), in contrast with the more moderate levels of LGBM (+23.5%) and GBR (+27.6%). Overall, the results are stable and consistent, as demonstrated by the small

discrepancy between the R^2 values on the test set and those obtained during cross-validation (CV-validation), with differences ranging from 0.013 to 0.032.

Table 3: Performance results (R^2 values) of the trained algorithms for the rental price prediction models.

Model	Name	CV-validation R^2 values (SD)	R^2 values		
			Training set (70%)	Test set (30%)	Overfitting (%)
Linear Regression	LR	-	0.4426	0.4290	-
Random Forest Regressor	RF	0.5601 (0.0062)	0.7394	0.5925	+24.8
Extra Trees Regressor	ET	0.5384 (0.0031)	0.6876	0.5569	+23.5
Gradient Boosting Regressor	GBR	0.6134 (0.0032)	0.8018	0.6286	+27.6
Extreme Gradient Boosting	XGBM	0.6099 (0.0059)	0.8753	0.6227	+40.6
Light Gradient Boosting Machine	LGBM	0.6143 (0.0031)	0.7810	0.6324	+23.5

Note: Training subset $N = 71,019$; Test subset $N = 30,705$.

Table 4 presents the error metrics for each algorithm, specifically MAE, MSE, and RMSE. As these metrics are error-oriented, higher values clearly indicate worse performance. In this regard, the models based on boosting techniques (GBR, XGBM, and LGBM) continue to stand out as the best overall performers.

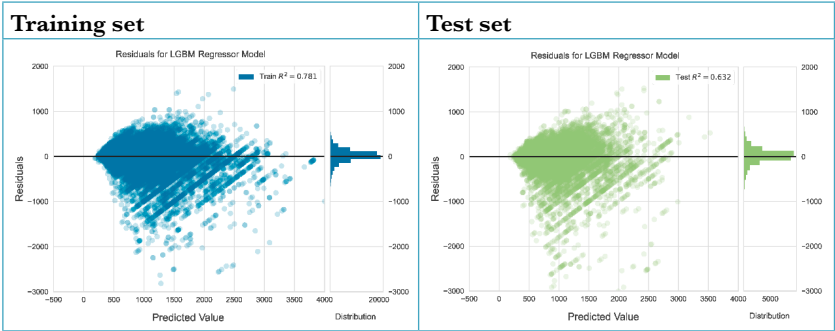
Table 4: Performance results (error values) of the trained algorithms on the test subset.

Model	Name	Performance metrics		
		MAE	MSE	RMSE
Linear Regression	LR	211	118,524	344
Random Forest Regressor	RF	164	84,577	290
Extra Trees Regressor	ET	173	91,970	303
Gradient Boosting Regressor	GBR	152	77,087	277
Extreme Gradient Boosting	XGBM	152	78,310	279
Light Gradient Boosting Machine	LGBM	152	76,297	276

Note: MAE = Mean Absolute Error; MSE = Mean Squared Error; RMSE = Root Mean Squared Error.

Residual plots provide a visual and qualitative evaluation that complements the quantitative performance metrics of the model. Figure 4 illustrates the behavior of the LGBM algorithm on both the training and test sets, allowing for an assessment of its generalization capability. The residual distribution appears random and slightly centered around zero, without the presence of systematic patterns or discernible structures. This behavior suggests that the model effectively captures the underlying relationship between the independent variables and the dependent variable. Likewise, the similarity in the residual distribution across both the training and test sets indicates a low incidence of overfitting, reinforcing the model’s robustness and its ability to generalize to unseen data.

Figure 4: Residual plots of the trained LGBM algorithm.



Regarding training time, XGBM and LGBM are positioned as the most computationally efficient algorithms, with XGBM being particularly fast across all evaluated sample sizes. In contrast, the RF and ET algorithms exhibit significantly longer computation times, which can become prohibitive for large datasets.

For the final evaluation of model performance, the algorithms were retrained using the entire dataset (100% of the data) and the best hyperparameters previously obtained. The corresponding results are presented in Table 5, showing high R^2 values for XGBM, GBR, and LGBM. However, the final model selection should consider not only predictive performance but also other factors such as computational efficiency and generalization capability. Although XGBM achieves the best fit, its high level of overfitting compromises its ability to generalize to new data. Consequently, GBR and LGBM emerge as

the most robust options, combining strong performance with lower overfitting risk and shorter computation times, making them more suitable candidates for future applications involving previously unseen data.

Table 5: Error metrics and goodness-of-fit measures of the algorithms on the entire dataset (multiple metrics).

Algorithm name	Model performance for the entire data sample			
	MAE	MSE	RMSE	R ²
LR	207.5	109,097.6	330.3	0.4380
RF	137.3	52,531.8	229.2	0.7294
ET	151.3	63,541.7	252.1	0.6727
GBR	117.7	40,102.2	200.2	0.7934
XGBM	99.7	27,917.7	167.1	0.8562
LGBM	128.9	46,564.5	215.8	0.7601

Note: MAE = Mean Absolute Error; MSE = Mean Square Error; RMSE = Root Mean Squared Error; R² = Coefficient of Determination.

3.3. Model Interpretation

Figure 5 presents the results of the feature importance evaluation using permutation, applied to the two best-performing algorithms in the previous stages of the study (GBR and LGBM). In both models, variables related to the geographic location of the property stand out, with longitude being particularly relevant. This indicates significant variation in prices based on east-west location within the province of Alicante.

The quarter feature (year and quarter) also appears among the most influential, reflecting a marked increase in rental prices over the studied time period.

Regarding the intrinsic characteristics of the property, built area, number of bathrooms, and number of bedrooms are consolidated as the most decisive attributes in price estimation. In contrast, the presence of an elevator does not appear to be a particularly relevant variable in the rental market.

Figure 5: Relative importance of the most relevant features according to the algorithms GBR y LGBM.

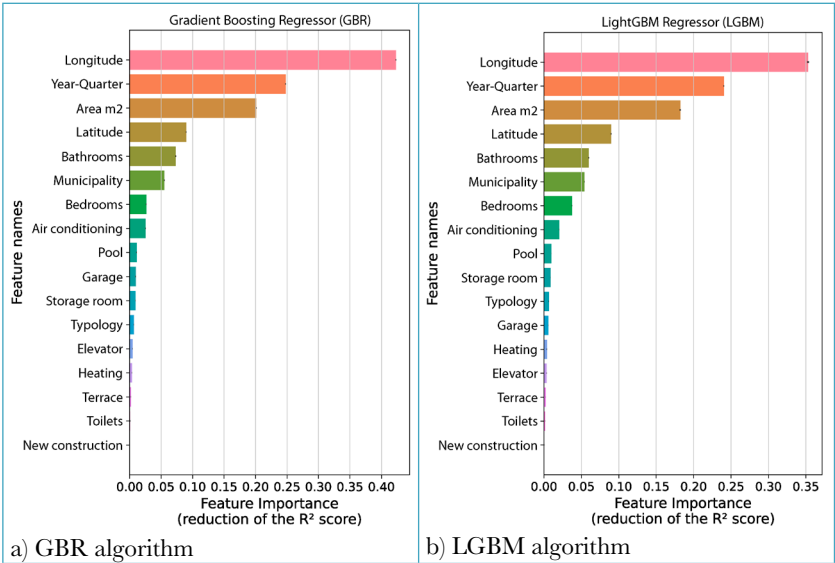
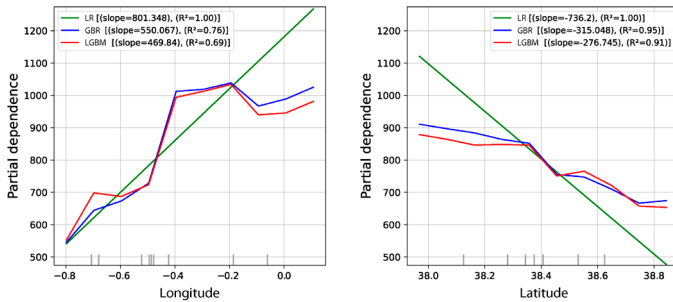


Figure 6 shows the partial dependence plots corresponding to the location features. These plots reveal that rental prices tend to be higher in the eastern areas of the region, while they progressively decrease toward the west.

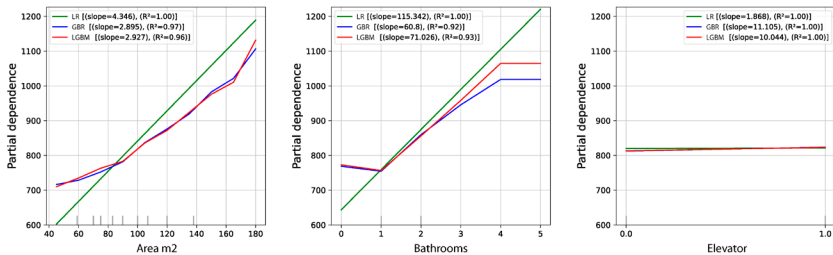
The GBR and LGBM models capture more complex relationships than the linear regression (LR) model, although they maintain a consistent trend with it, particularly in the analysis of the latitude coordinate. The only notable discrepancy lies in the behavior of the longitude coordinate, where the nonlinear models introduce greater variability in the shape of the curve.

Figure 6: Unidirectional partial dependence plots for the longitude and latitude coordinates with the LR, GBR, and LGBM algorithms.



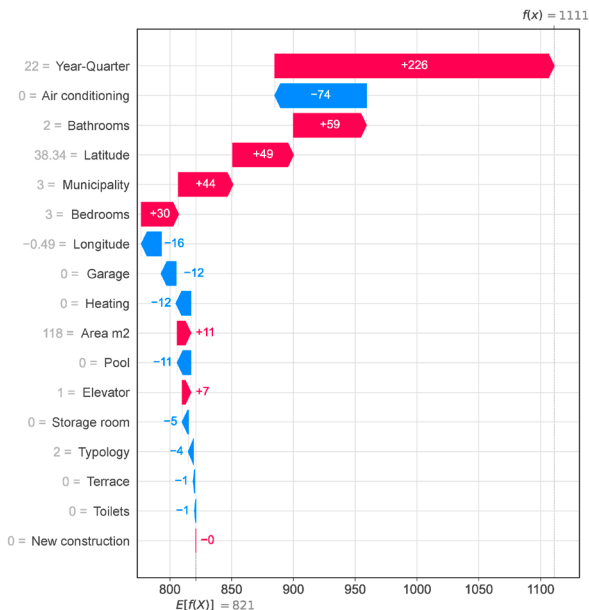
To illustrate the behavior of other features, three representative features have been selected, which are shown in the PDP plots in Figure 7: two continuous features (constructed area and number of bathrooms) and one binary feature (presence of an elevator). The interpretation of these plots has been complemented with the calculation of the slopes of the best-fit lines, which allow estimating the average impact of each variable on rental price. Thus, for every additional square meter of area, the monthly rent increases by an average of approximately 3 euros. In the case of the number of bathrooms, an additional bathroom results in an estimated increase of between 61 and 71 euros per month. The presence of an elevator is associated with an average increase of between 10 and 11 euros compared to a similar property that lacks this feature.

Figure 7: Unidirectional partial dependence plots for the features area, number of bathrooms, and elevator obtained with the LR, GBR, and LGBM algorithms.



Regarding the local interpretation of the model, Shapley values (SHAP) have been used, a technique based on cooperative game theory that allows decomposing the result of a prediction into the individual contributions of each feature. Figure 8 presents a waterfall plot that shows the SHAP estimation for a specific case: a property offered for rent in the city of Alicante during the fourth quarter of 2024. In this plot, the value $E[f(x)]$ represents the average model prediction across the entire sample (821 €), which acts as the base value. From this value, the contributions of each feature are added or subtracted until the final model prediction, $f(x) = 1,111$ €, is reached. Features that increase the price are shown in red, while those that decrease it are represented in blue. In this example, the year-quarter feature has the highest positive impact on the price, contributing +226 €, while the absence of air conditioning has a negative impact of -74 € on the final estimate. This type of explanation provides a transparent and understandable view of the model’s functioning at an individual level, facilitating its practical application and boosting confidence in its predictions.

Figure 8: Waterfall plot for a rental database observation, estimation performed using the LGBM algorithm.



3.4. Model Deployment

In this phase of the research, a web application has been developed to put the predictive model into production, allowing estimations based on data manually entered by the user. The tool is available with open access, aimed at facilitating its use by anyone interested, including real estate professionals and potential investors who wish to run simulations and obtain automated estimates.

One of the fundamental requirements for development was to ensure that both server maintenance and the use of the virtual machine were free of charge, additionally promoting the exclusive use of open-source software throughout the implementation. Python programming language was used for developing the application, integrating the Streamlit package, which allows the deployment of interactive web applications with the possibility of free hosting (<https://preciosdevivienda.streamlit.app/>).

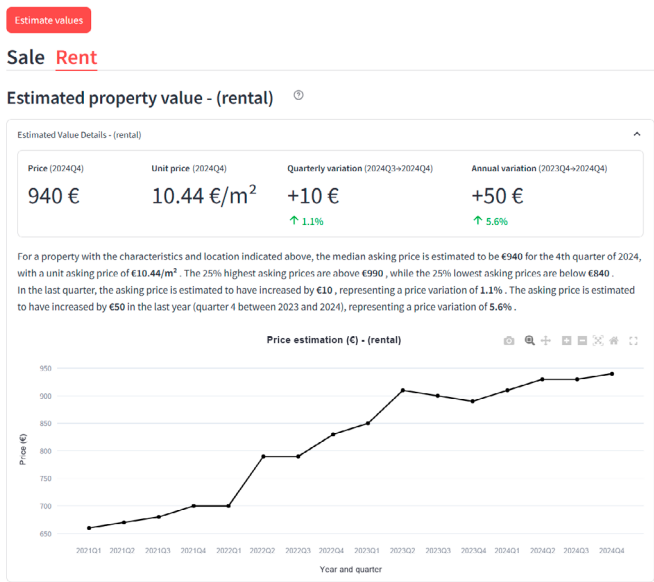
The data entry interface is organized into three main sections: 1) Property characteristics (Figure 9); 2) Geographic location; and 3) Estimation results (Figure 10). In the first section, the user can specify the property type, built area, number of bedrooms, bathrooms, and toilets, as well as other relevant additional features. In the location section, the user is asked to provide a valid cadastral reference, either 14 or 20 characters long. The system performs an automatic check to verify the existence of the property, providing an approximate address along with its geographical coordinates.

Figure 9: Data entry screen for property characteristics.

The screenshot displays the 'Estimate value' web application interface. At the top, there are three steps: Step 1 (Enter the characteristics that describe the property to be valued), Step 2 (Enter a cadastral reference to locate the property), and Step 3 (Get an estimate of values by clicking the Estimate Values button). Below the steps, the 'Property features' section is visible, containing a 'Feature Details' form. The form includes a 'Home information' section with a text input for 'Enter the features that describe the home and click "Save Features." After making any changes, you must also save them.' and a 'Housing typology' dropdown menu set to 'Floor'. The 'Surface (m²)' is set to '90'. There are three numeric input fields for 'Number of bedrooms' (3), 'Number of bathrooms' (2), and 'Number of toilets' (0). Below these are several toggle switches for additional features: 'New construction' (off), 'Elevator' (on), 'Storage room' (off), 'Air conditioning' (off), 'Terrace' (off), 'Garage' (off), 'Pool' (off), and 'Heating' (off). A 'Save features' button is located at the bottom left of the form.

In the final section, the application displays the estimation results. A summary of the total estimated value (in euros) and the unit value (euros per square meter) is provided, along with the price variation during the last quarter and the past year. To facilitate the interpretation of the results, a brief textual explanation is included, highlighting the most relevant elements of the analysis. Additionally, a graph showing the historical evolution of the property’s estimated price is provided, allowing the user to contextualize the price trends over time.

Figure 10: Estimation results screen, summary, and estimation graph.



Additionally, a waterfall chart is included, representing the SHAP (SHapley Additive exPlanations) values, which illustrates the process by which the model adjusts the estimated price starting from the average value (see Figure 8). This chart allows users to identify the features that contribute positively to the increase in the property’s price, as well as those that have a negative effect, reducing the estimated value. This tool facilitates a better understanding of the model’s behavior and provides relevant information about the relative influence of each feature on the final prediction.

4. Conclusions

This study has allowed the development, optimization, and interpretation of a set of machine learning models aimed at estimating housing rental prices. Through a systematic process of training, validation, and evaluation, it has been demonstrated that boosting-based algorithms—particularly LGBM and GBR—offer the best balance between predictive performance, generalization capability, and computational efficiency.

The optimization of hyperparameters through cross-validation has highlighted the usefulness of combining random and Bayesian search strategies, although with limited differences in their final performance. The LGBM and GBR models have shown consistent results across various error metrics (MAE, MSE, RMSE) and the coefficient of determination (R^2), as well as a lower tendency for overfitting compared to XGBM, which, despite achieving the best fit on the data, has a more limited generalization capability.

The interpretability analysis of the machine learning models, both global and local, has identified the most relevant features in predicting rental prices. Among these, geographic location (especially longitude), the temporal year-quarter, built area, and the number of bathrooms stand out, while other features, such as the presence of an elevator, have a marginal influence in this market.

From an applied perspective, a publicly accessible web application has been developed, allowing any user—whether individuals, professionals, or investors—to estimate the current and historical rental value of a property based on its characteristics. Additionally, this tool provides detailed explanations through SHAP values, contributing to a better understanding and increased confidence in the predictions generated.

Overall, this work not only proposes a rigorous and replicable approach for rental price estimation using artificial intelligence but also offers an interpretable and accessible system with practical application potential in contexts such as automated valuation, urban planning, and decision-making in the real estate market.

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5. Bibliography

- [1] Park B, Bae JK. Using machine learning algorithms for housing price prediction: The case of Fairfax County, Virginia housing data. *Expert Systems with Applications* [Internet]. 2015;42(6):2928–34. Available from: <https://doi.org/10.1016/j.eswa.2014.11.040>
- [2] Antipov EA, Pokryshevskaya EB. Mass appraisal of residential apartments: An application of Random forest for valuation and a CART-based approach for model diagnostics. *Expert Systems with Applications* [Internet]. 2012;39(2):1772–8. Available from: <https://doi.org/10.1016/j.eswa.2011.08.077>
- [3] Čeh M, Kilibarda M, Lisec A, Bajat B. Estimating the Performance of Random Forest versus Multiple Regression for Predicting Prices of the Apartments. *ISPRS International Journal of Geo-Information* [Internet]. 2018;7(5):168. Available from: <https://doi.org/10.3390/ijgi7050168>
- [4] Embaye WT, Zereyesus YA, Chen B. Predicting the rental value of houses in household surveys in Tanzania, Uganda and Malawi: Evaluations of hedonic pricing and machine learning approaches. *PLOS ONE* [Internet]. 2021;16(2):e0244953. Available from: <https://doi.org/10.1371/journal.pone.0244953>
- [5] Gnat S. Property Mass Valuation on Small Markets. *Land* [Internet]. 2021;10(4):388. Available from: <https://doi.org/10.3390/land10040388>
- [6] Hong J. An Application of XGBoost, LightGBM, CatBoost Algorithms on House Price Appraisal System. *Housing Finance Research* [Internet]. 2020;4:33–64. Available from: <https://doi.org/10.52344/hfr.2020.4.0.33>
- [7] Hong J, Choi H, Kim W-S. A house price valuation based on the random forest approach: the mass appraisal of residential property in South Korea. *International Journal of Strategic Property Management* [Internet]. 2020;24(3):140–52. Available from: <https://doi.org/10.3846/ijspm.2020.11544>
- [8] Kok N, Koponen E-L, Martínez-Barbosa CA. Big Data in Real Estate? From Manual Appraisal to Automated Valuation. *Journal of Portfolio Management* [Internet]. 2017;43(6):202–11. Available from: <https://doi.org/10.3905/jpm.2017.43.6.202>
- [9] Rico-Juan JR, Taltavull de La Paz P. Machine learning with explainability or spatial hedonics tools? An analysis of the asking prices in the housing market in

- Alicante, Spain. Expert Systems with Applications [Internet]. 2021;171:114590. Available from: <https://doi.org/10.1016/j.eswa.2021.114590>
- [10] Xu L, Li Z. A New Appraisal Model of Second-Hand Housing Prices in China's First-Tier Cities Based on Machine Learning Algorithms. Computational Economics [Internet]. 2021;57(2):617–37. Available from: <https://doi.org/10.1007/s10614-020-09973-5>
- [11] Yilmazer S, Kocaman S. A mass appraisal assessment study using machine learning based on multiple regression and random forest. Land Use Policy [Internet]. 2020;99:104889. Available from: <https://doi.org/10.1016/j.landusepol.2020.104889>
- [12] Mora-Garcia RT, Cespedes-Lopez MF, Perez-Sanchez VR. Housing Price Prediction Using Machine Learning Algorithms in COVID-19 Times. Land [Internet]. 2022;11(11):2100. Available from: <https://doi.org/10.3390/land11112100>
- [13] Alfaro-Navarro J-L, Cano EL, Alfaro-Cortés E, García N, Gámez M, Larraz B. A Fully Automated Adjustment of Ensemble Methods in Machine Learning for Modeling Complex Real Estate Systems. Complexity [Internet]. 2020;2020(1):5287263. Available from: <https://doi.org/10.1155/2020/5287263>
- [14] Canaz Sevgen S, Aliefendioğlu Y. Mass Appraisal With A Machine Learning Algorithm: Random Forest Regression. Bilişim Teknolojileri Dergisi [Internet]. 2020;13(3):301–11. Available from: <https://doi.org/10.17671/gazibtd.555784>
- [15] Ho WKO, Tang B-S, Wong SW. Predicting property prices with machine learning algorithms. Journal of Property Research [Internet]. 2021;38(1):48–70. Available from: <https://doi.org/10.1080/09599916.2020.1832558>
- [16] Hu L, He S, Han Z, Xiao H, Su S, Weng M, et al. Monitoring housing rental prices based on social media: An integrated approach of machine-learning algorithms and hedonic modeling to inform equitable housing policies. Land Use Policy [Internet]. 2019;82:657–73. Available from: <https://doi.org/10.1016/j.landusepol.2018.12.030>
- [17] Pai P-F, Wang W-C. Using Machine Learning Models and Actual Transaction Data for Predicting Real Estate Prices. Applied Sciences [Internet]. 2020;10(17):5832. Available from: <https://doi.org/10.3390/app10175832>

Scientometric Study of Ecological Awareness and Moral Commitment in Water Use in the Fields of Social and Economic Sciences

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Abstract

his article aims to analyze the collaboration between authors in the fields of moral commitment and ecological awareness in water use within scientific production in social and economic sciences from 1976 to 2023. The study employed a scientometric approach, reviewing a total of 736 articles in the Web of Science (WoS) related to ecological awareness and 912 in Scopus. Additionally, 412 articles in WoS and 880 in Scopus focused on moral commitment were examined. This analysis revealed significant literary connections between both categories in the explored fields of knowledge. The search was conducted in three key periods: March 2021, January 2022, and November 2023. The data was exclusively obtained from the Web of Science (SCI-EXPANDED or SSCI) and Scopus, focusing on the areas of “Business, Management and Accounting,” “Economics, Econometrics and Finance,” “Decision

Sciences,” and “Multidisciplinary.” Bibliometric analyses were applied through the Law of Exponential Growth (PRICE), the Law of Aging or Obsolescence of Scientific Literature (PRICE), the Law of Author Productivity (LOTKA), the Law of Scientific Literature Dispersion (BRADFORD), and the Linguistic Law or Disciplines with Standard Distribution (ZIPF) to identify trends and collaborations, using tools like Vosviewer to visualize spatial patterns, co-authorship, and keyword co-occurrence. The main findings focus on the 45 prolific authors in moral commitment, organized into 11 collaboration clusters, and 52 authors in ecological awareness with similar connections. However, a lack of inter-cluster connections was observed, suggesting a geographical focus in the research. The most frequent keywords were analyzed, revealing seven thematic clusters in each area, such as business ethics and climate change, highlighting the interrelationship between ethics, leadership, and sustainability.

Keywords: Ecological awareness, moral commitment, scientometrics, academic collaboration, scientific productivity, knowledge management.

1. Introduction

In the contemporary academic field, research on moral commitment and ecological awareness in relation to water use has gained significant relevance due to the growing concern for environmental sustainability and ethics in business and management practices (1). These two interrelated fields, although distinct in their approach, share the common goal of promoting responsible behaviors toward natural and social resources. However, the way these issues are addressed within the social and economic sciences presents unique challenges and opportunities that require detailed analysis and a deep understanding (2).

The categorization of studies on moral commitment and ecological awareness in water use faces the diversity of theoretical and methodological approaches employed by researchers to address these topics (3). From ethical perspectives to economic and management analyses, there is a variety of conceptual frameworks that influence how these phenomena are conceptualized and studied in the academic literature, but there is still a broad interest in understanding how they converge. This diversity not only enriches the field but also presents

challenges in terms of integration and comparability of findings between studies (4).

The problem of categorization also lies in the fragmentation and dispersion of the scientific literature on these topics. Despite the growth in the number of studies, the connection between different subfields and disciplines within the social and economic sciences is often limited (5). This can make it difficult to build an integrated knowledge framework that addresses the ethical and environmental issues related to water holistically.

Furthermore, the temporality of studies and the evolution of theoretical and practical perspectives over time pose challenges for synthesizing and extrapolating results (6). Research on moral commitment and ecological awareness in water use from 1976 to 2023 reflects significant changes in the understanding and application of these concepts, which requires a critical assessment of how they have evolved and how these lessons can be applied to the contemporary context.

This led to the formulation of the following research question: How can the different theoretical approaches in research on ecological awareness and moral commitment in water use within social and economic sciences be integrated to develop a coherent and globally applicable knowledge framework? The concentration of studies in certain scientific bases may limit the global applicability of the findings and bias perspectives on the challenges and solutions related to water use (7). This disparity in regional representation highlights the need for comparative and collaborative studies like this one, which expand the knowledge base and foster a more global understanding of the issues at hand.

For this reason, the study proposes as its goal to analyze collaboration among authors in the fields of moral commitment and ecological awareness in water use within scientific production in social and economic sciences. From a methodological standpoint, a qualitative approach was used through scientometric analysis. This qualitative approach, which explores individual perceptions and behaviors, could influence the interpretation and comparison of results, leading to the construction of a coherent and robust knowledge base.

Together, these challenges and opportunities underscore the importance of a detailed and critical analysis of the existing literature on moral commitment and ecological awareness in water use in social and economic sciences (8). This problem statement seeks to address these complexities in order to advance understanding and the sustainable management of our water resources in an ever-changing global context.

2. Theoretical Framework

2.1. Environmental Awareness from Literary Findings.

Environmental awareness refers to individuals' understanding and sensitivity to environmental issues and their willingness to take actions to mitigate them (9). This awareness involves a deep understanding of global and local environmental challenges, such as climate change, biodiversity loss, air and water pollution, among others. Furthermore, environmental awareness, in terms of water conservation, implies understanding how our individual and collective actions impact this vital resource today and for future generations (8). Individuals with high environmental awareness tend to adopt more sustainable behaviors in their daily lives, such as reducing energy consumption, using public transport or bicycles, and minimizing waste.

2.2. Moral Commitment from Literary Findings.

Moral commitment refers to individuals' willingness to act ethically and responsibly, even when there are no external incentives to do so (10). This commitment is based on deep-rooted personal principles and values that guide a person's decisions and actions in ethically complex situations. Moral commitment involves a profound connection with principles of justice, fairness, and respect for others and the environment, and it is manifested through altruistic and prosocial behaviors, as well as resistance to the temptation to act contrary to ethical values (11).

From this perspective, it is influenced by various factors, including upbringing, education, religion, and personal experiences. Social justice theory and moral development theory provide conceptual frameworks to understand how moral commitment forms and manifests over time (12). Moreover, research has shown that individuals with high moral commitment tend to have better mental health and overall well-being, and in an increasingly complex and diverse world, moral commitment plays a key role in promoting ethical behaviors and building fairer and more sustainable societies.

3. Materials and Methods

This study used a qualitative review approach to examine the relationships between ecological awareness and moral commitment in social and economic sciences. The search was conducted in three key periods: March 2021, January 2022, and November 2023 (13). The data used in this study were obtained through Web of Science (WoS) and Scopus, focusing on the keywords “Ecological Awareness and Moral Commitment, Water” in the scientific productivity areas “Business, Management and Accounting, Economics, Econometrics and Finance, Decision Sciences, and Multidisciplinary.” Subsequently, a scientometric analysis was performed.

From a methodological perspective, a bibliometric approach was used to conduct a review on the relationship between the study variables (14). The data for this study were obtained through Web of Science (WoS) and Scopus using the following search strings: TS= (Ecological awareness /0 Ecological awareness) Refined By: Web of Science Index: Science Citation Index Expanded (SCI-EXPANDED) or Social Sciences Citation Index (SSCI), followed by a bibliometric analysis.

The information was addressed inductively, meaning there was no predefined guide or analysis categories to provide step-by-step guidance. When generating data through Vosviewer, it was immediately identified that the thematic focus would revolve around the concepts of Ecological Awareness and Moral Commitment to Water. By exclusively using the WoS and Scopus indexing database, information from other databases that are not comparable in terms of citations was excluded, as several studies indicate that the results

of systematic literature reviews can vary depending on the database used. The search was conducted on May 27, 2024 (14).

For the study of scientific production, Price's Law was used to evaluate the annual exponential growth of published documents, based on the adjusted determination coefficient (R^2) of the trendline using Microsoft Excel (Dwivedi, Y. K., Hughes, D. L., Coombs, C., Constantiou, I., Duan, Y., Edwards, J. S., . . . Upadhyay, N., 2020). Similarly, it was used to corroborate whether there is scientific community interest in advancing research on a topic. Applying Lotka's Law to authors was used to identify the most prolific authors and study them separately from other authors with fewer articles, based on the unequal distribution of scientific production among authors (15).

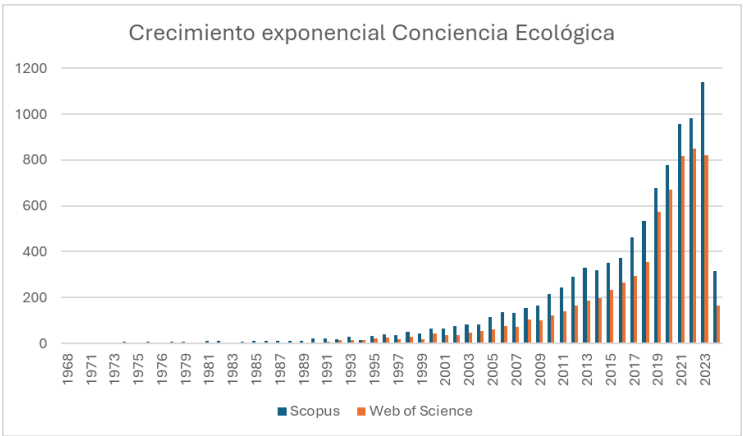
To observe how some documents in this set form the basis for creating new knowledge (subsequent documents), the Hirsch index (h-index) was employed, which specifies a set of "n" documents with "n" or more citations (Eckert, M., Volmerg, J. S., & Friedrich, C. M., 2019). Finally, for the analysis of scientific production areas, Zipf's Law was used to determine the most commonly used keywords in a document set, estimated using the square root of the total number of keywords, with complementary adjustments based on power law, which can be verified with the determination coefficient (R^2) (16)

The processing of information and the visualization of spatiality, co-authorship, co-occurrence, countries, and keywords were analyzed using Vosviewer software, employing fragmentation analysis for the visualization of temporal and thematic trends (17).

4. Results

Between 1976 and 2023, a total of 9,418 articles on Ecological Awareness (EA) were published in WoS and 6,655 in Scopus. However, scientific production decreased when applying search criteria focused on social and economic sciences "Business, Management and Accounting, Economics, Econometrics and Finance, Decision Sciences, and Multidisciplinary" (See Figure 1).

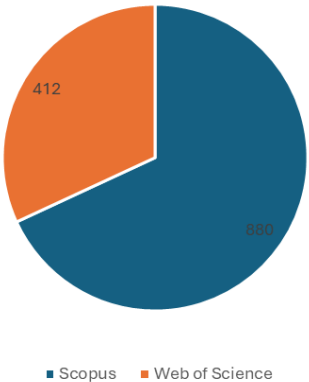
Figure 1: Exponential Growth of Ecological Awareness



Source: *Exponential Growth of Ecological Awareness*, own elaboration.

Subsequently, a scientometric analysis by decade reveals that it is in the last three decades where there has been a significant increase in publications on this topic, with the mid-2000s seeing the highest flow of information, showing an R^2 of approximately 81%. Therefore, studies on the concept of Ecological Awareness (EA) presented a considerable number of research articles, with 880 in WoS and 412 in Scopus.

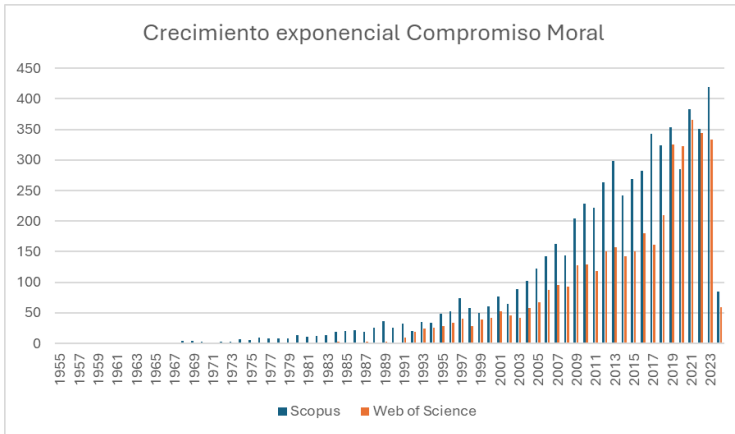
Figure 2: Refinement Criteria of Productivity.



Source: *Refinement Criteria for Ecological Awareness, Business, Management and Accounting, Economics, Econometrics and Finance, Decision Sciences, and Multidisciplinary*, own elaboration.

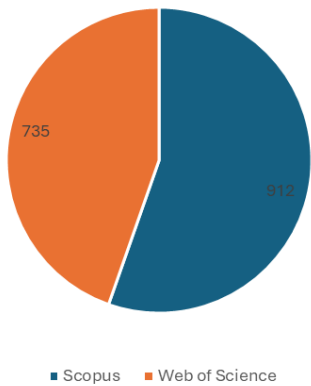
Similarly, between 1976 and 2023, a total of 3,237 articles on Moral Commitment (MC) were published in WoS and 6,203 in Scopus. However, scientific production decreased when the search criteria were focused on social and economic sciences: “Business, Management and Accounting, Economics, Econometrics and Finance, Decision Sciences, and Multidisciplinary” (See Figure 3).

Figure 3: Exponential Growth of Moral Commitment.



Source: Exponential Growth of Moral Commitment, own elaboration. Subsequently, a scientometric analysis by decade reveals that it is in the last three decades where there has been a real surge in publications on this topic, with the mid-2000s seeing the highest flow of information, demonstrating an R^2 of approximately 85%. Therefore, studies on the concept of MC showed a considerable amount of research with 735 articles in WoS and 912 in Scopus (See Figure 4).

Figure 4: Refinement Criteria of Productivity.



Source: Refinement Criteria of Moral Commitment, Business, Management and Accounting, Economics, Econometrics and Finance, Decision Sciences, and Multidisciplinary, own elaboration.

The total of 1,292 articles represents the scientific production of 6,571 authors, and prolific authors were estimated using Lotka’s Law (17) (square root of 6571 $\approx$ 81.06). Therefore, it was estimated that the authors with the highest contribution to the production of this knowledge were 81, considering a minimum of 2-4 published documents in the WoS and Scopus databases and a minimum of 83 citations for each author (See Table 1).

Table 1: Prolific Authors in Ecological Consciousness Studies in WoS and Scopus.

Web Of Science		Scopus	
Authors	Number of Documents	Authors	Number of Documents
Aytekin A	2	Yusliza, M.Y.	4
Blanc S	2	Pavlovich, K.	4
Brouwer R	2	Muhammad, Z.	4
Brun F	2	Okumus, F.	3
Barba-sánchez V	2	Mangla, S.K.	3
Bröring S	2	Farooq, K.	3
Börger T	2	Che, Y.	3
Carraresi L	2	Brécard, D.	3
Demaria F	2	Xue, B.	2
Dopico A	2	Wilson, P.A.	2

Source: Own elaboration.

However, given the discrete number of articles (Table 1), it is interesting to note that, of the 1292 articles, 93.97% were contributions from authors with only 2 articles published or co-authored, and similarly, 4.96% have participated in 3 or more articles. These constitute 98.93% of the total publications on Ecological Awareness in WOS and Scopus, as these authors can be considered prolific since they have contributed to the generation of knowledge only once or twice on this topic (see Tables 2 and 3).

Table 2: Most Cited Papers in Ecological Awareness Studies in WOS.

N.	Title	Authors	Publisher	Citations
1	A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems	Ghisellini, Patrizia, Cialani, Catia y Ulgiati, Sergio	Journal Of Cleaner Production (2016)	2,596
2	Sample selection bias and presence-only distribution models: implications for background and pseudo-absence data	Phillips, Steven J., Dudik, Miroslav, Elith, Jane, Graham, Catherine H., Lehmann, Anthony, Leathwick, John y Ferrer, Simon	Ecological Applications (2009)	1,965
3	The Hidden World within Plants: Ecological and Evolutionary Considerations for Defining Functioning of Microbial Endophytes	Hardoim, Pablo R., van Overbeek, Leonard S, Berg, Gabriele, Pirttilä, Anna Maria, Compant, Stephane, Campisano, Andrea, Doering, Matthias y Sessitsch, Angela	Microbiology And Molecular Biology Reviews (2015)	1,393
4	Microbiome Datasets Are Compositional: And This Is Not Optional	Gloor, Gregory B., Macklaim, Jean M., Pawlowsky-Glahn, Vera y Egozcue,	Frontiers In Microbiology (2017)	1,328

N.	Title	Authors	Publisher	Citations
5	Facilitation in plant communities: the past, the present, and the future	Brooker, Rob W. et al.	Journal Of Ecology (2008)	1,299
6	Suicide prevention strategies revisited: 10-year systematic review	Zalsman, Gil, Hawton, Keith y Wasserman, Danna et al.	Lancet Psychiatry (2016)	998
7	A comprehensive model of the psychology of environmental behaviour-A meta-analysis	Klockner, Christian A.	Global Environmental Change-Human And Policy Dimensions (2013)	877
8	Predicting global change impacts on plant species' distributions: Future challenges	Thuiller, Wilfried, Albert, Cecile, Araujo, Miguel B. et al.	Perspectives In Plant Ecology Evolution And Systematics (2008)	863
9	Understanding and managing conservation conflicts	Redpath, Steve M., Young, Juliette, Evelyn, Anna et al.	Trends In Ecology & Evolution (2013)	810
10	Situation awareness: Review of Mica Endsley's 1995 articles on situation awareness theory and measurement	Wickens, Christopher D.	Human Factors (2008)	736

Source: Own elaboration.

Table 3: Most Cited Works in Ecological Awareness Studies in Scopus.

N.	Title	Authors	Publisher	Citations
1	A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems	Ghisellini, P., Cialani, C., Ulgiati, S.	Journal of Cleaner Production (2016)	3,175
2	Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature	Beske, P., Land, A., Seuring, S.	International Journal of Production Economics (2014)	634

N.	Title	Authors	Publisher	Citations
3	Integrating energy efficiency performance in production management - Gap analysis between industrial needs and scientific literature	Bunse, K., Vodicka, M., Schönsleben, P., Brühlhart, M., Ernst, F.O.	Journal of Cleaner Production (2011)	592
4	Human-started wildfires expand the fire niche across the United States	Balch, J.K., Bradley, B.A., Abatzoglou, J.T., Fusco, E.J., Mahood, A.L.	Proceedings of the National Academy of Sciences of the United States of America (2017)	566
5	An institutional analysis of payments for environmental services	Vatn, A.	Ecological Economics (2010)	542
6	Risk analysis in green supply chain using fuzzy AHP approach: A case study	Mangla, S.K., Kumar, P., Barua, M.K.	Resources, Conservation and Recycling (2015)	374
7	Consumer behavior and purchase intention for organic food	Paul, J., Rana, J.	Journal of Consumer Marketing (2012)	364
8	Plastic pollution in the marine environment	Thushari, G.G.N., Senevirathna, J.D.M.	Helvion, (2020)	338
9	Environmental awareness and initiatives in the Swedish and Polish hotel industries-survey results	Bohdanowicz, P.	International Journal of Hospitality Management (2006)	319
10	Remote sensing for lake research and monitoring - Recent advances	Dörnhöfer, K., Oppelt, N.	Ecological Indicators (2016)	298

Source: Own elaboration.

The total of 1,647 articles represents the scientific output of 7,451 authors, and prolific authors were estimated using Lotka's Law (17), (square root of $7,451 \approx 81.06$). Therefore, it was estimated that the authors with the greatest contribution to the production of this knowledge were 81, considering a minimum of 2–5 documents

published in the WOS and Scopus databases and a minimum of 90 citations per author (see Tables 4 and 5).

Table 4: Prolific Authors in Moral Commitment Studies in WOS and Scopus.

Web Of Science ris3			Scopus	
	Authors	Number of Documents	Authors	Number of Documents
1	Perry SL	4	Caldwell, C.	5
2	Ruiz-palomino P	4	Hielscher, S.	4
3	Di Bartolomeo G	3	Walser, R.D.	3
4	Dionne G	3	Strudler, A.	3
5	Ha-brookshire J	3	Schminke, M.	3
6	Hielscher S	3	Pies, I.	3
7	Martínez-cañas R	3	Papa, S.	3
8	Papa S	3	Hasan, Z.	3
9	Simha A	3	Ha-Brookshire, J.	3
10	Wang XY	3	Farnsworth, J.K.	3

Source: Own elaboration.

However, given the discrete number of articles (Table 4), it is interesting to note that, out of the 1,647 articles, 98.85% were contributions from authors with only 2 published articles or co-authorships, and similarly, 3.96% have participated in only 3 or more articles. These account for 98.93% of the total publications on Moral Commitment in WOS and Scopus, as these authors can be considered prolific due to having contributed to the generation of knowledge only once or twice on this topic (see Tables 5 and 6).

Table 5: Most Cited Works in Moral Commitment Studies in WOS.

N.	Title	Authors	Publisher	Citations
1	Prioritizing the Mental Health and Well-Being of Healthcare Workers: An Urgent Global Public Health Priority	Sovold, Lene E., Naslund, John A., Kousoulis, Antonis A., Saxena, Shekhar, Qoronfleh, M. Walid, Grobler, Christoffel y Munter, Lars	Frontiers In Public Health	232
2	Saliva Direct: A simplified and flexible platform to enhance SARS- CoV-2 testing capacity	Vogels, Chantal B. F., Watkins, Anne E, Harden, Christina A. et al	Med (2021)	169
3	Corporate social responsibility and pro-environmental behavior at workplace: The role of moral reflectiveness, coworker advocacy, and environmental commitment	Afsar, Bilal y Umrani, Waheed Ali	Corporate Social Responsibility And Environmental Management (2020)	148
4	A Meta-Analytic Review of Paternalistic Leadership	Bedi, Akanksha	Applied Psychology - An International Review- Psychologie Appliquee- Revue Internationale (2020)	53
5	Walking the Talk on Diversity: CEO Beliefs, Moral Values, and the Implementation of Workplace Diversity Practices	Ng, Eddy S. y Sears, Greg J.	Journal Of Business Ethics (2020)	49
6	Final-year nursing students called to work: Experiences of a rushed labour insertion during the COVID- 19 pandemic	Gomez-Ibanez, Rebeca, Watson, Carolina, Manuel Leyva-Moral, Juan, Aguayo - Gonzalez, Mariela y Granel,	Nurse Education In Practice	44

N.	Title	Authors	Publisher	Citations
7	Linking Entrepreneurial Orientation with Innovation Performance in SMEs; the Role of Organizational Commitment and Transformational Leadership Using Smart PLS-SEM	Iqbal, Shuja, Martins, Jose Moleiro, Mata, Mario Nuno, Naz, Shumaila, Akhtar, Shamim y Abreu, Antonio	Sustainability (2021)	43
8	Can paternalistic leaders enhance knowledge sharing? The roles of organizational commitment and Islamic work ethics	Chaudhary, Arooba, Islam, Talat, Ali, Hafiz Fawad y Jamil, Saqib	G l o b a l Knowledge Memory And Communication (2023)	42
9	Forty years of research on factors influencing ethical decision making: Establishing a future research agenda	Casali, Gian Luca y Perano, Mirko	Journal Of Business Research (2021)	37

Source: Own elaboration.

Table 6: Most Cited Works in Moral Commitment Studies in Scopus.

N.	Title	Autors	Publisher	Citations
1	Loyalty-based management.	Reichheld, F.F.	Harvard Business Review (1993)	780
2	Protected Values	Baron, J., Spranca, M.	Organizational Behavior and Human Decision Processes (1997)	522
3	Identity, morals, and taboos: Beliefs as assets	Bénabou, R., Tirole, J.	Quarterly Journal of Economics (2011)	426
4	Corporate social responsibility in the 21st century: A view from the world's most successful firms	Snider, J., Hill, R.P., Martin, D.	Journal of Business Ethics (2003)	410
5	Seeking legitimacy for new assurance forms: The case of assurance on sustainability reporting	O'Dwyer, B., Owen, D., Unerman, J.	Accounting, Organizations and Society (2011)	391

N.	Title	Autors	Publisher	Citations
6	Three roads to organizational justice	Cropanzano, R., Rupp, D.E., Mohler, C.J., Schminke, M.	Research in Personnel and Human Resources Management (2001)	325
7	The seeds of a crisis: A theory of bank liquidity and risk taking over the business cycle	Acharya, V., Naqvi, H.	Journal of Financial Economics (2012)	318
8	The effect of leader moral development on ethical climate and employee attitudes	Schminke, M., Ambrose, M.L., Neubaum, D.O.	Organizational Behavior and Human Decision Processes (2005)	293
9	The Role of Lockups in Initial Public Offerings	Brav, A., Gompers, P.A.	Review of Financial Studies (2020)	282
10	Governmentality Matters: Designing an Alliance Culture of Inter-organizational Collaboration for Managing Projects	Clegg, S.R., Pitsis, T.S., Rura-Polley, T., Marosszeky, M.	Organization Studies (2002)	270

Source: Own elaboration.

Table 7: Institutions and Sources on the Topic of Ecological Awareness in WOS and Scopus.

Web Of Science			Scopus	
N.	Institution or University	Qty.	Institution or University	Qty.
1	Centre National De La Recherche Scientifique Cnrs	12	Chinese Academy of Sciences	10
2	INRAE	8	Wageningen University & Research	8
3	Universite De Montpellier	7	Beijing Normal University	7
4	Autonomous University Of Barcelona	6	Universität Bonn	6
5	Institut Agro	6	The Hong Kong Polytechnic University	6
6	Institut Agro	6	University of KwaZulu- Natal	6
7	University Of Bonn	6	Technische Universität München	6
8	Chinese Academy Of Sciences	5	Uniwersytet Jagielloński	6
9	University Of Queensland	5	The University of Queensland	6

Web Of Science			Scopus	
N.	Institution or University	Qty.	Institution or University	Qty.
10	University Of Tennessee System	5	Universiti Teknologi MARA	5

Source: Own Elaboration.

Table 8: Publishers and Sources on the Topic of Ecological Awareness in WOS and Scopus.

Web Of Science			Scopus	
N.	Editorial	Qty.	Editorial	Qty.
1	Sustainability	246	Journal Of Cleaner Production	67
2	Ecological Economics	95	Ecological Economics	42
3	Ecological Indicators	92	Environment Development And Sustainability	31
4	Journal Of Cleaner Production	80	Marine Policy	24
5	Science Of The Total Environment	78	Resources Conservation And Recycling	14
6	International Journal Of Environmental Research And Public Health	73	Journal Of Sustainable Tourism	11
7	Plos One	70	Resources Policy	10
8	Journal Of Environmental Management	46	Journal Of Outdoor Recreation And Tourism	10
9	Biological Conservation	38	Resources Science	9
10	Environmental Science And	38	Forest Policy And	9

Source: Own Elaboration.

Table 9: Countries with Scientific Productivity on the Topic of Ecological Awareness in WOS and Scopus.

Web Of Science			Scopus	
N.	Country	Qty.	Country	Qty.
1	Usa	69	United States	121
2	Peoples R China	47	China	112

Web Of Science			Scopus	
N.	Country	Qty.	Country	Qty.
3	Germany	41	United Kingdom	60
4	England	37	Germany	59
5	Spain	32	India	52
6	France	29	Australia	43
7	Italy	23	Italy	39
8	Australia	18	France	37
9	Canada	16	Spain	36
10	Netherlands	15	Poland	35

Source: Own elaboration.

Table 10: Institutions and sources on the topic of Moral Behavior in WOS and Scopus.

Web Of Science			Scopus	
N.	Institution or University	Qty.	Institution or University	Qty.
1	UNIVERSITY OF LONDON	15	University of Pennsylvania	8
2	HARVARD UNIVERSITY	13	Stanford University	8
3	UNIVERSITY OF MELBOURNE	12	National Bureau of Economic Research	8
4	UNIVERSITY OF TEXAS SYSTEM	11	University of Melbourne	8
5	NATIONAL BUREAU OF ECONOMIC RESEARCH	10	Harvard University	7
6	UNIVERSITY OF CALIFORNIA SYSTEM	10	University of Oxford	7
7	UNIVERSITY SYSTEM OF OHIO	10	Universität Zürich	6
8	NEW YORK UNIVERSITY	9	University of Virginia	6
9	STANFORD UNIVERSITY	8	University of California, Berkeley	6
10	UNIVERSITE DE MONTREAL	8	HEC Montréal	5

Source: Own elaboration.

Table 11: Countries on the topic of Moral Behavior in WOS and Scopus.

Web Of Science			Scopus	
N	Country	Qty.	Country	Qty.
1	Perry SL	4	United States	322
2	Ruiz-palomino P	4	United Kingdom	105
3	Di Bartolomeo G	3	Germany	41
4	Dionne G	3	Australia	41
5	Ha-brookshire J	3	France	39
6	Hielscher S	3	Canada	34
7	Martínez-cañas R	3	Italy	32
8	Papa S	3	Spain	30
9	Simha A	3	Netherlands	29
10	Wang XY	3	China	29

Source: Own elaboration.

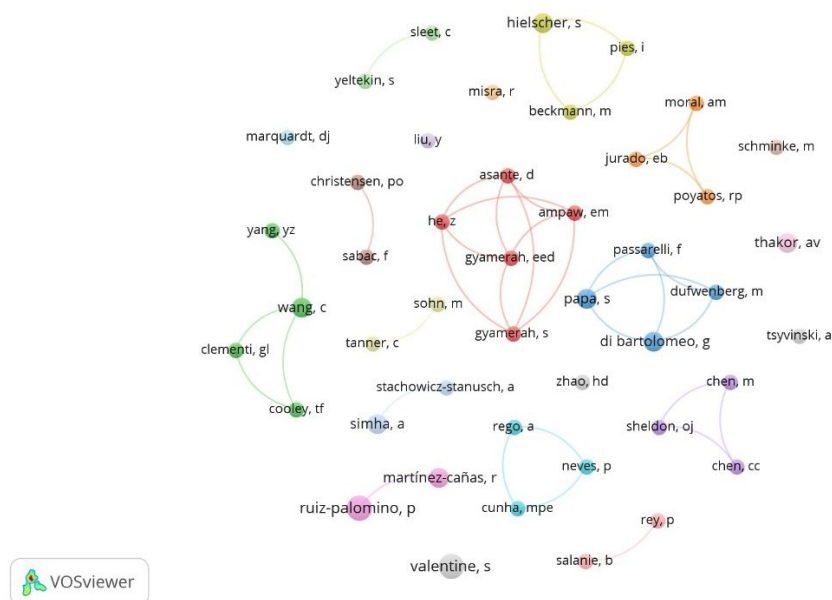
Table 12: Publishers and source on the topic of Moral Behavior in WOS and Scopus.

Web Of Science			Scopus	
N.	Editorial	Qty.	Editorial	Qty.
1	Journal Of Business Ethics	109	Journal Of Business Ethics	80
2	Journal Of Medical Ethics	18	Science And Engineering Ethics	17
3	Bioethics	16	Developments In Marketing Science Proceedings Of The Academy Of Marketing Science	14
4	American Journal Of Bioethics	8	Business Ethics Quarterly	10
5	Journal Of Bioethical Inquiry	8	Plos One	8
6	Leadership Organization Development Journal	8	Mediterranean Journal Of Social Sciences	7
7	Business Ethics Quarterly	7	Journal Of Management Development	7
8	International Journal Of Ethics And Systems	7	Public Integrity	6
9	Kennedy Institute Of Ethics Journal	7	Journal Of Economics And Management Strategy	6
10	Management Science	7	Ethical Economy	6

Source: Own elaboration.

As shown in Figure 5, from the Web of Science database, of the 2019 authors who have published as either authors or co-authors, applying Lotka's law, the prolific authors on the topic of moral commitment are 45 authors. Collaborative work connections were found in 11 clusters; however, no inter-cluster connections were observed that would help visualize collaborations between authors (See Figure 5).

Figure 5: Prolific co-authorship figure and its relationships on Moral Commitment.



Source: Own elaboration.

In Table 13, each of the clusters is detailed in terms of their institutional and national affiliation.

Table 13: Prolific author groups and affiliations with 4 or more connections on Moral Commitment.

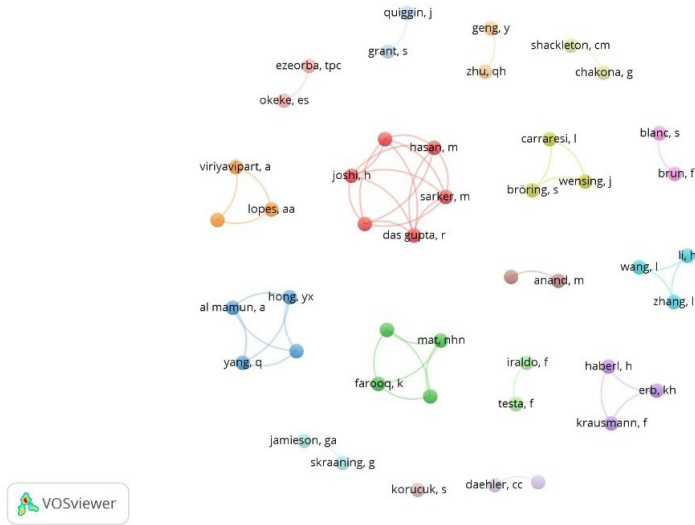
Nombre de los autores	Red
Gyamerat, Eed	Red
He, Z	Red
Gyamerat, S	Red

Nombre de los autores	Red
Ampaw, EM	Red
Asante, D	Red
Yang, YZ	Green
Cooley, TF	Green
Clementi, GL	Green
Wang, C	Green
Di Bartolomeo, G	Blue
Dufwenberg, M	Blue
Papa, S	Blue
Passarelli, F	Blue
Dionne, G	Yellow
Lam, LW	Yellow
Liu, Y	Yellow
Picard, P	Yellow

Source: Own elaboration.

For ecological awareness, out of the 2,656 authors who have published applying Lotka's law, only 52 can be considered prolific authors. Similarly, it is evident that there are connections between authors, but no interconnections between other research groups, indicating that studies have focused on certain countries without extending research beyond the idiosyncrasies of these countries (See Figure 6).

Figure 6: Prolific co-authorship figure and their relationships on Ecological Awareness.



Source: Own elaboration.

In Table 14, each of the clusters is detailed in terms of their institutional and national affiliation.

Table 14: Prolific author groups and affiliations with 4 or more connections in Ecological Awareness.

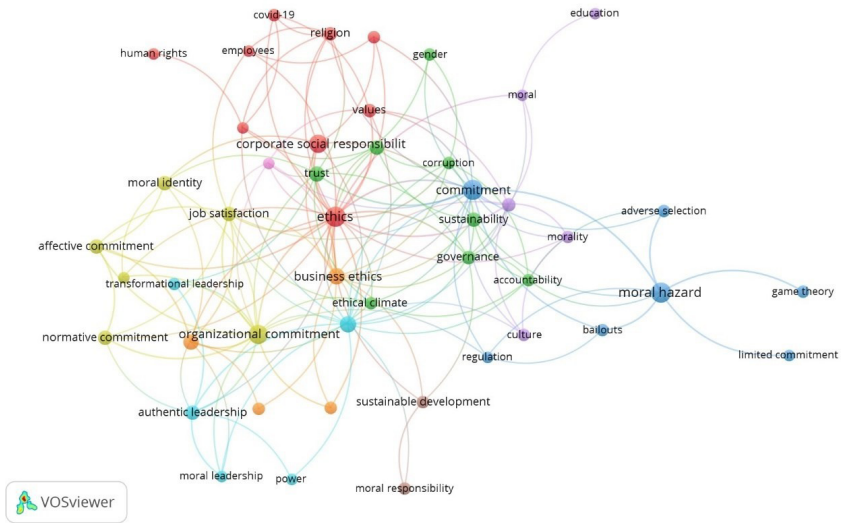
Nombre de los autores	Red
Das Gupta, R	Red
Haider, MR	Red
Hasan, M	Red
Sarker, M	Red
Joshi, H	Red
Sutradhar, I	Red
Farooq, K	Green
Mat, NHN	Green
Muhammad, Z	Green
Yusliza, MY	Green
Li, H	Yellow
Li, YY	Yellow
Wang, I	Yellow
Zhag, I	Yellow

Source: Own elaboration.

As part of the findings, it cannot be overlooked how these prolific authors have contributed to the publication on moral awareness and ecological awareness, where collaborative works have helped to gain a clearer understanding of these topics.

From the Scopus database, the scientific production on moral commitment was analyzed, and keyword groups were created. A total of 2443 keywords were analyzed, and based on Zipf's law, 50 keywords were selected, considering the square root of 2443 ($=49.42$) as the estimator, with the highest frequency of usage (See Figure 7).

Figure 7: Keyword co-occurrence graph of Moral Commitment.

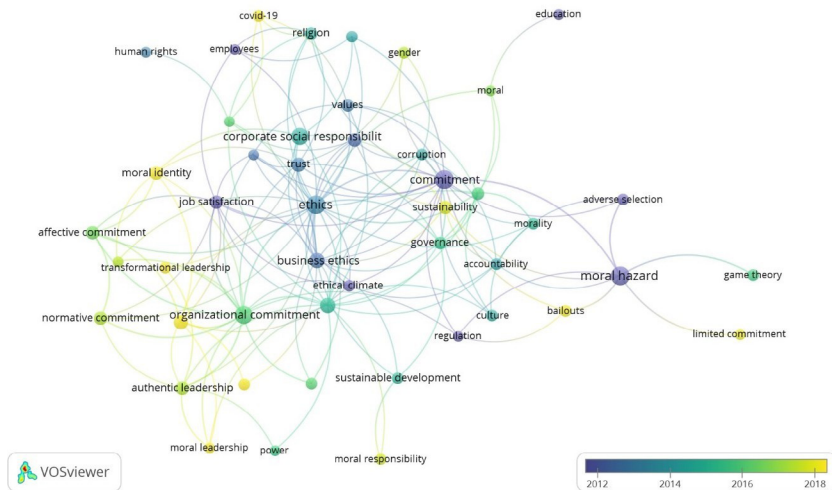


Source: Own elaboration.

The set of keywords generated seven thematic clusters that demonstrate the interdisciplinary nature of moral commitment. The blue cluster focuses on concepts such as commitment, rescues, limited commitment, gamma theory, adverse selection, and regulation. The yellow cluster addresses moral identification, job satisfaction, commitment norms, commitment effectiveness, and committed organizations. The brown cluster includes moral responsibility and sustainable development. The red cluster highlights ethical issues, corporate social responsibility, employment, human risks, and values. The sky blue cluster explores authentic and transformational

leadership. The green cluster brings together topics like governance, sustainability, corruption, ethical climate, and accountability. Finally, the purple cluster emphasizes culture, morality, and education, while the orange cluster refers specifically to business ethics. Notably, the connections between these seven clusters are significant, revealing a strong network of interrelated themes surrounding the study of moral commitment (see Figure 8).

Figure 8



Source: Own elaboration.

The previous illustration highlights that recent research trends related to moral commitment can be identified as follows (see Table 15).

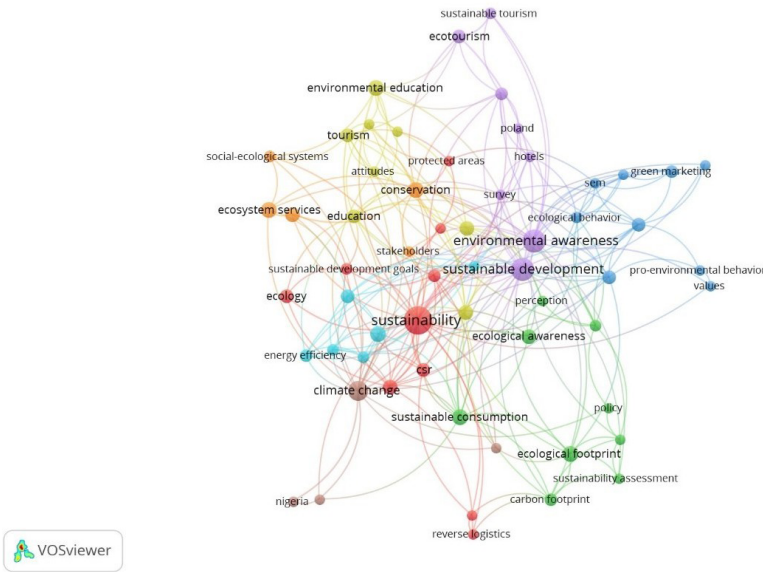
Table 15: Mature Keywords and Emerging Themes on Moral Commitment.

Emerging Themes	Emerging Themes
Job Satisfaction	Sustainability
Human Risk	Moral Identity
Ethics	Moral Leadership
Values	Bounded Commitment
Moral Hazard	Transformational Leadership

Source: Own elaboration.

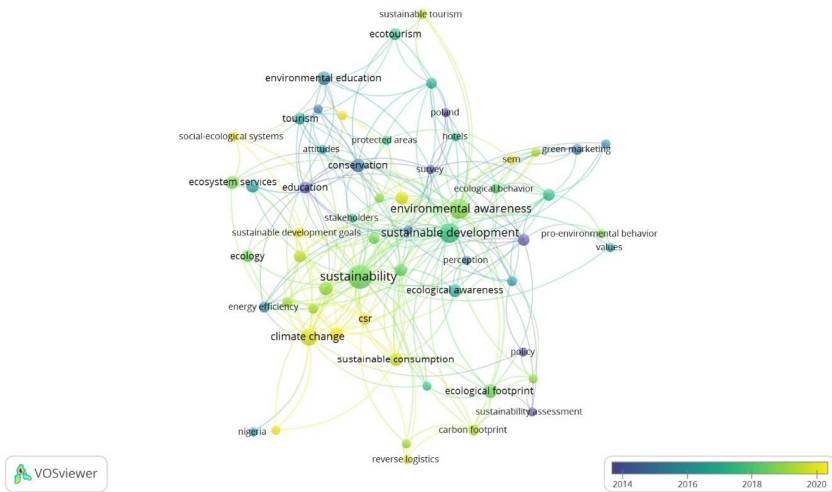
In turn, the scientific output on ecological awareness was analyzed, leading to the formation of keyword clusters. Out of a total of 3,514 keywords, and following Zipf's law, 59 keywords were selected, using the square root of 3,514 ($= 59.27$) as an estimator, representing those with the highest frequency of use (See Figure 9).

Figure 9: Keyword co-occurrence graph on Ecological Awareness.



Source: Own elaboration.

Thus, the set of keywords generated seven clusters: the blue cluster is focused on biological behavior, green marketing, and values; the yellow cluster centers on education, skills, tourism, and environmental education; the red cluster addresses topics such as sustainability, ecology, change, and the development of sustainable goals; the green cluster refers to ecological awareness, carbon footprint, perception, consumption, and policy; the purple cluster includes environmental awareness, sustainable development, ecotourism, and sustainable tourism; the orange cluster highlights ecosystem services, conservation, stakeholders, and socio-ecological systems; and the brown cluster deals with climate change. It is important to emphasize that the level of connection among the seven clusters is significant (See Figure 10).

Figure 10: Topics related to Ecological Awareness.

5. Discussion

Moral commitment and ecological awareness in the use of water within fields such as social and economic sciences reveal a complex intersection of theories, methodological approaches, and empirical findings (17). Throughout the decades analyzed, from 1976 to 2023, significant progress has been made in understanding how ethical and environmental decisions impact the sustainable management of water resources. The theoretical foundations provided have enabled exploration of these topics from multiple perspectives, ranging from business ethics to environmental psychology and ecological economics (15).

The integration of ethical theories, such as utilitarianism and deontology, has enriched the discussion on how organizations and individuals make morally responsible decisions concerning water. This is particularly crucial in a global context where water scarcity and environmental impacts are becoming increasingly evident (16). Furthermore, the application of economic and resource management theories has provided insights into the incentives and barriers to

adopting sustainable practices, showing how market mechanisms can align with environmental goals.

The discussion has also underscored the importance of environmental governance and public policy in promoting ethical and sustainable water use practices. Effective regulation and collaboration among multiple stakeholders are essential to ensuring that ethical decisions translate into concrete actions that benefit both the environment and affected communities (14). Environmental justice and sustainable development emerge as guiding principles that should inform water-related policies and practices, ensuring equitable access and fair distribution of this vital resource.

6. Conclusions

The study of moral commitment and ecological awareness in water use within the social and economic sciences has proven to be essential in addressing contemporary challenges related to sustainability and environmental ethics. Through a multidisciplinary approach and the application of diverse theories, significant progress has been made in understanding how individual and organizational decisions affect long-term water resource management.

However, important challenges remain, such as the need for more effective integration of theoretical and methodological approaches and the improvement of geographic and cultural representation in research. Future studies should focus on strengthening international collaboration and effective governance, as well as on developing practical strategies to promote ethical and sustainable behavior across all sectors of society.

Ultimately, continued engagement with these issues is not only crucial for protecting our water resources, but also for advancing toward a more just and equitable global development model, where ethics and environmental sustainability serve as fundamental pillars of our actions and decisions.

7. Bibliography

- [1] Acevedo-Duque, Á.; Vega-Muñoz, A.; Salazar-Sepúlveda, G. Analysis of Hospitality, Leisure, and Tourism Studies in Chile. *Sustainability* 2020, 12, 7238. <https://doi.org/10.3390/su12187238>
- [2] Chenoweth, J., López-Avilés, A., Morse, S., & Druckman, A. (2016). Water consumption and subjective wellbeing: An analysis of British households. *Ecological Economics*, 130, 186-194. <https://doi.org/10.1016/j.ecolecon.2016.07.006>
- [3] Duque, Á. A., Álvarez-Herranz, A., & Marinao-Artigas, E. (2023). Scientometrics study of country branding and its contribution to sustainable development in nations. *Data and Metadata*, 2, 163-163.DOI: <https://doi.org/10.56294/dm2023163> Dwivedi, Y. K., Hughes, D. L., Coombs, C., Constantiou, I., Duan, Y., Edwards,
- [4] J. S., Upadhyay, N. (2020). Impact of COVID-19 pandemic on information management research and practice: Transforming education, work and life. *International Journal of Information Management*, 55. <https://doi.org/10.1016/j.ijinfomgt.2020.102211>
- [5] Eckert, M., Volmerg, J. S., & Friedrich, C. M. (2019). Augmented Reality in Medicine: Systematic and Bibliographic Review. *JMIR Mhealth Uhealth*, 7(4). <https://doi.org/10.2196/10967>
- [6] Elblaus, L., Unander-Scharin, A., & Unander-Scharin, C. (2017). Uncanny Materialities: Digital Strategies for Staging Supernatural Themes Drawn from Medieval Ballads. *Leonardo Music Journal*, 27, 62-66. https://doi.org/10.1162/LMJ_a_01020
- [7] González-Díaz, R. R., Acevedo-Duque, Á. E., Guanilo-Gómez, S. L., y Cruz-Ayala, K. (2021). Ruta de Investigación Cualitativa – Naturalista: Una alternativa para estudios gerenciales. *Revista de Ciencias Sociales (Ve)*, XXVII(Especial 4), 334- 350.
- [8] Lowe, B., Lynch, D., & Lowe, J. (2015). Reducing household water consumption: a social marketing approach. *Journal of marketing management*, 31(3-4), 378-408. <https://doi.org/10.1080/0267257X.2014.971044>
- [9] Molina, E., Quesada, F., Calle, A., Ortiz, J., & Orellana, D. (2018). Consumo sustentable de agua en viviendas de la ciudad de Cuenca. *Ingenius. Revista de Ciencia y Tecnología*, (20), 28-37. <https://doi.org/10.17163/ings.n20.2018.03>
- [10] Manco Silva, D. G., Guerrero Erazo, J., & Ocampo Cruz, A. M. (2012). Eficiencia en el consumo de agua de uso residencial. *Revista Ingenierías Universidad de Medellín*, 11(21), 23-38.
- [11] Pérez, Z. E. R., González, M. J. C., & Romero, D. C. R. (2020). Estimación y hábitos del consumo de agua para fines domésticos en una zona residencial de San Cristóbal, Venezuela. *Revista Luna Azul*, (51), 95-120. <https://doi.org/10.17151/luaz.2020.51.6>
- [12] Salem, M. Z., & Ertz, M. (2023). Water consumption rationalization using demarketing strategies in the Gaza Strip, Palestine. *Water Resources and Economics*, 43, 100227. <https://doi.org/10.1016/j.wre.2023.100227>

- [13] Sepúlveda Moreno, C. O., Moreno Moreno, L. R., & Millán López, N. T. (2023). Explorando las Emociones y la Conciencia del Agua en Sonora, México: Un Análisis sobre su Impacto en el Cuidado del Recurso Hídrico.
- [14] Zulqarnain, A., & Khan, M. A. (2024) Thirsty nation: An investigation into water scarcity and public conservation behaviour in Pakistan. *Water and Environment Journal*. <https://0711bgzpq-y-https-doi-org.itmsp.museknowledge.com/10.1111/wej.12930>

Social entrepreneurship: a holistic vision in Wayuu communities in the Riohacha district

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Abstract

The purpose of the article was to analyze social entrepreneurship from a holistic perspective in the Wayuu communities of the Riohacha district. The methodology used a quantitative paradigm, descriptive research, with a non-experimental, transactional, and field design. The population consisted of 30 female leaders of artisan SMEs registered with the Riohacha Chamber of Commerce. A population census was applied to collect information using a survey and a 13-item questionnaire, evaluated by five experts, with a calculated reliability of 90%. The data collected were interpreted using descriptive statistics. In conclusion, social entrepreneurship in the Wayuu communities of the Riohacha district represents a holistic vision that addresses the needs of the environment through integrated and sustainable solutions. This approach promotes collaboration and teamwork, focusing on sustainable construction through entrepreneurial initiatives, specifically the creation of artisanal products by Wayuu family SMEs, led by women, which stand out as a key strategy. These entrepreneurs generate viable economic alternatives, ensuring the well-being and quality of life of their communities. As

forgers of the common good, they drive local development that respects and values the cultural heritage of their ancestors, while also contributing to the economic and social sustainability of their ancestral spaces.

Keywords: Social entrepreneurship, holistic vision, Wayuu communities, women leaders, SMEs, Wayuu crafts.

1. Introduction

Social entrepreneurship in the Wayuu communities of the Riohacha District presents a holistic vision that addresses the current challenges of new socioeconomic models in Latin America. This approach facilitates the productive interaction of entrepreneurial SMEs in global markets, allowing the goods and services derived from their activities to meet social demand. Therefore, constant economic transformations drive the creation of strategies that ensure market stability, adaptation to emerging trends, and improved quality of life. According to Paz and Prieto (1), entrepreneurial activities must be structured to foster social well-being, generate income, improve coexistence, and promote socioeconomic development.

Within this framework, social entrepreneurship plays a role in generating social change by addressing local realities with a comprehensive and collaborative commitment. Social entrepreneurs, particularly women, seek opportunities not only to react to problems but to create positive impacts and transform traditional social structures into sustainable ones, ensuring the common good. This perspective views both men and women as a team, capable of contributing to income generation in an integral way (2)(3). Female entrepreneurship is seen as a tool for achieving recognition equivalent to that of men's efforts, while also valuing its impact on society, the local economy, and the progress of the environment.

According to Durán et al. (4) and Barragán et al. (5), entrepreneurship combines innovative ideas that respond to social needs, creating value and economic development. Paz, Castro, and Palacio (6) perceive it as an agent that fosters the inclusion of activities aimed at social transformation, implementing ideas that help solve community problems.

In this specific context, social entrepreneurship in the Wayuu communities of the Riohacha district involves women as key players, contributing to the creation of handicrafts for cultural preservation, economic development, and community empowerment. These women maintain cultural hegemony, acting as leaders and co-participants in the development of their communities, strengthening their work through inclusive policies, market access, and cultural recognition to ensure the sustainability of their communities with products made by their ethnicity.

According to Saavedra, Camarena, and Vargas (7), social entrepreneurship is grounded in a process where the entrepreneur's role is to add value to the economy through business opportunities, accumulating resources, marketing products and services, producing goods, building an organization, and responding to government and society. Franco, Prieto, Paz, and Meslier (8) state that social entrepreneurship creates opportunities that add value to community development through initiatives that help improve quality of life and the common welfare of all.

In this sense, handicrafts play a holistic role in the Wayuu culture, representing an economic activity vital to the community, with Wayuu women being the primary artisans. Their role in crafting handicrafts is multifaceted, encompassing cultural, social, and economic aspects. According to Meléndez, Montoya, and Vélez (9); Espinosa and Gelvez (10), in Wayuu culture, older women play a crucial role in transmitting traditions and values, especially during the transition from girlhood to womanhood. This knowledge transfer is interwoven with daily social life, where meanings are built that enrich understanding of culture, the connection to the land, and language mastery. These characteristics define the Wayuu woman as an entrepreneur in her community, actively participating in the general well-being through cultural practices and contributions to the creation of native products.

Women symbolize ancestral preservation as guardians of cultural heritage, which manifests in their crafts, especially weaving. From an early age, Wayuu girls learn weaving techniques from their mothers and grandmothers, making this practice an intergenerational legacy. Handcrafted products such as bags, hammocks, and blankets are not only utilitarian objects but carriers of ancestral symbols and

narratives reflecting the Wayuu worldview, from a holistic perspective that sustains their knowledge.

The role of the social entrepreneur, particularly the Wayuu woman, stands out for her commitment to the community and her role as a transformative leader of social change, which involves working collaboratively with her people to create continuous improvements in living conditions. In this context, inclusive businesses aim to build bridges between business opportunities and low-income populations, benefiting both sectors (11). Social entrepreneurs in the Wayuu communities must act by promoting cooperation and community integration to develop sustainable projects that benefit the collective.

Wayuu handicrafts have transcended the borders of the communities, gaining recognition in both national and international markets. Wayuu women play a crucial role in the economy of their communities by producing and marketing these handicrafts, being responsible for providing income to support their families and contribute to local economic development. Moreover, it becomes a source of empowerment as these women develop business and leadership skills by managing the production and sale of their products. This economic empowerment translates into greater participation in decision-making within their communities, promoting greater gender equality.

Wayuu craftsmanship is closely linked to a solidarity-based and sustainable economy. Wayuu women often organize in cooperatives and work groups, where they collaborate and share resources and knowledge. This model strengthens social cohesion, ensuring an equitable distribution of economic benefits derived from handicrafts. This practice transforms the social and economic environment, driving quality of life through innovation and solidarity-based economy (12).

Despite its importance, Wayuu women face challenges in creating handicrafts. Globalization and competition with industrial products can jeopardize the authenticity and value of traditional handicrafts. Additionally, the lack of access to broader markets and limited commercial infrastructure are significant obstacles. However, the growing global appreciation for sustainable and handcrafted products presents an opportunity for Wayuu artisans to expand their reach and strengthen their traditional practices. Therefore, this management

improves living conditions while also promoting innovation and a solidarity-based economy (13). Based on the aspects mentioned, the objective is to analyze social entrepreneurship as a holistic vision in the Wayuu communities of the Riohacha district.

2. Theoretical Framework

2.1. Social Entrepreneurship: A Holistic Scenario

The social realm, along with environmental transformations, demands the protagonism of individuals capable of generating ideas based on their knowledge, skills, abilities, attitudes, and social values. These individuals must assume their behaviors, responsibilities, and functions as social entrepreneurs. According to Moreno, Parra, Villasmil, Hernández, and Durán (14), entrepreneurs integrate into their environment by adopting a participatory, consultative, and innovative management approach to address the needs of their community, transforming a traditional approach into a holistic scenario of full participation from their people to achieve the established and necessary objectives.

The role of the social entrepreneur is key to integrating and projecting the community toward the construction of a sustainable society. Sánchez et al., cited by Guedez (15) define the social entrepreneur as a manager who promotes participation, organization, and coordination of efforts to achieve common goals and integrate the community. They study present situations in communities and, with the support of their members, can plan actions to improve quality of life and culture, emphasizing the elements that determine national identity.

The social entrepreneur is a person who promotes social change with sensitivity and solidarity within communities, fostering the understanding and appreciation of the social, environmental, and cultural manifestations of their surroundings. This is the case of the Wayuu communities in the District of Riohacha, where efforts are made to unite with community leaders, particularly women, to integrate community members into the creation of native products

that contribute to sustainability and inclusive, endogenous economic growth, thus improving quality of life. According to Curto (16), for a social entrepreneur's initiative to have an impact, five key points must be evaluated: ensuring the product or service is ready for expansion, guaranteeing community acceptance of the project, planning available and future resources, evaluating risks, and defining expected outcomes.

In general, the aspects documented by the cited authors show that the social entrepreneur is a person committed to the social transformation of communities through socioeconomic participation mechanisms to address the community's needs, forming a symbiotic relationship between the entrepreneur and the community. This approach facilitates teamwork to improve quality of life and common well-being toward the sustainable development of the community. Gabaldón (17) emphasizes that sustainable development ensures continuous improvement in quality of life, with equity for the current population without compromising future generations.

Female social entrepreneurs are characterized by proposing initiatives based on a holistic scenario to change the dynamics of the Wayuu communities in the district of Riohacha, activating community work from their qualities to meet their socio-economic and cultural needs. Vainrub (18) describes a social entrepreneur as someone characterized by their initiative in social matters, decision-making ability, awareness of their own limitations, results-oriented approach, adaptability to change, and generosity, in addition to being a leader.

They also create spaces for coexistence that promote common well-being and social equity, symbolizing shared progress. Drayton, cited by Soto and Cárdenas (19) describes the social entrepreneur as someone who looks toward the future, identifying the key steps to move in the right direction. Calanchez, Ríos, Zevallos, and Silva (2) state that the social entrepreneur stands out for projecting objectives to improve the social, environmental, and cultural environment, creating creative and sustainable solutions to address complex challenges in society. The authors agree that social entrepreneurs develop strategies to drive meaningful transformations from the practice of their qualities.

The Wayuu women from the communities are guardians of their ancestral culture, characterized by their qualities as talented

and visionary entrepreneurs who play a vital role in the sustainable development of their communities. They create native products that reflect their unique identity and contribute to the economic and social progress of their people. Ordoñez et al. (3) refer to the qualities, knowledge, and invaluable competencies of women entrepreneurs, which allow them to identify improvement opportunities and generate positive changes that add value to their ventures. These skills, combined with their practical qualities, ensure local development, acting as an essential engine for the sustainability of society and the country in general. Furthermore, research results by Meléndez et al. (8) and Siiger (20) add that indigenous women are distinguished by possessing qualities that support rooted leadership, allowing them to understand their role within the normative and social framework of their community, recognizing their contribution to collective progress and well-being.

3. Materials and Methods

This research work adheres to the quantitative paradigm, specifically the empirical-analytical approach, also known as the positivist or pragmatist approach. According to Palella and Martins (21), this approach is based on the premise that data is the scientific argument. The positivist paradigm allows the analysis of the object of study through the application of methodological techniques and instruments that collect opinions and relevant information from participants, providing a foundation for subsequent statistical analysis.

The quantitative approach is particularly suitable for research that requires objectivity and precision. This method allows the use of specific instruments for data collection, which are then coded, tabulated, and statistically analyzed. The objectivity and neutrality investigated through positivism facilitate the identification of patterns and regularities through systematic observation and precise measurement. In this context, this research adopts a quantitative methodology to ensure objective results, thus contributing to an understanding of the variable.

The research is classified as descriptive, focusing on the identification and analysis of the tangible elements of the studied variable. According

to Méndez (22) and Hernández and Mendoza (23), descriptive research seeks to identify and analyze the interrelation of various components to delimit the studied facts. This non-experimental design means that the data was not manipulated by the researchers, allowing a natural observation of the phenomena. Hernández, Fernández, and Baptista (24) highlight that non-experimental designs are carried out without manipulating the collected data, simply observing the phenomena in their natural setting.

The research is categorized as cross-sectional descriptive, meaning that data collection took place at a single point in time. Hernández et al. (23) explain that cross-sectional non-experimental designs collect data at one moment, providing a snapshot of the studied phenomenon. According to Arias (25), field research refers to the collection of data directly from the environment where the events occur, without manipulation or control of variables by the researcher. This approach ensures the collection of authentic and relevant data from the studied population.

The study population consisted of 30 female entrepreneurs from Wayuu communities in the district of Riohacha, dedicated to making Wayuu handicrafts. These businesses are formally registered with the district's chamber of commerce, representing a census that includes all study elements. The selection of this population ensures representation of Wayuu female entrepreneurs, aligned with the methodological principles described by Méndez (22) and Paz et al. (26).

For data collection, a survey was used with a 25-item multiple-choice questionnaire (always, almost always, sometimes, almost never, never). This instrument was evaluated by five experts in the field of entrepreneurship, ensuring its validity and reliability with a confidence level of 95% using Cronbach's alpha formula. The professional and impartial evaluation by the experts guarantees the accuracy and relevance of the data collection instrument. The collected information was analyzed using descriptive statistics, interpreted through a scale for the observation of average data.

This approach allows for the interpretation of results, facilitating the identification of patterns and trends in the entrepreneurial qualities of Wayuu women. The use of descriptive statistics provides an overview of the studied phenomenon, ensuring that the results obtained are meaningful and applicable to similar contexts.

Table 1: Data Interpretation Scale.

Rank	Category
$1,00 \leq 1,80$	Very low
$1,81 \leq 2,60$	Low
$2,61 \leq 3,40$	Moderate
$3,41 \leq 4,20$	High
$4,20 \leq 5,00$	Very high

Source: Own elaboration (2024)

4. Results

According to the entrepreneurial qualities of Wayuu women, the analysis reveals the presence of qualities that distinguish them as essential attributes for social entrepreneurship. The results obtained allow for outlining a profile that supports the theories established in the literature on social entrepreneurs. 53% of the surveyed population almost always seeks alternatives to meet the needs of their community, while 47% always do so. The average creativity indicator was 4.31, placing it in the high presence category. This finding aligns with the theories of Soto and Cárdenas (27), who state that social entrepreneurs are creative, able to overcome obstacles and set goals, acting as leaders who can form teams and collaborate with various sectors.

Regarding the innovation indicator, 50% of the surveyed women always propose ideas to support planned activities in the communities, 43% almost always do so, and 7% sometimes. The average for this indicator was 4.31, positioning it in the very high presence category. This confirms the theory of Paz, Castro, and Palacio (28), who highlight that social entrepreneurs are innovators, capable of generating ideas that improve community well-being through alliances and networks with both public and private entities. Regarding the tolerance indicator, 60% of Wayuu women entrepreneurs almost always collaborate in social activities, even when they disagree with some decisions, showing satisfaction with the results obtained for the well-being of the community, while 40% always do so. The average of this indicator is 4.09, with a high level of presence. This result is consistent with the theory of Soto and Cárdenas (27), which emphasizes the importance

of judging with discernment, connecting with feelings, and paying attention to actions.

50% of the surveyed women always take control of activities and initiatives, involving the community to meet collective needs, 43% almost always do so, and 7% sometimes. The average responsibility indicator was 4.36, indicating a very high level of presence. These data align with Paz, Castro, and Palacio (28), who assert that the responsibility of social entrepreneurs lies in their ability to make decisions and take actions that benefit the community.

53% of the surveyed women mentioned that they always promote community activities to engage people in solving community problems, and 47% do so almost always. The average visionary indicator was 4.42, showing a very high level of presence. This result supports the statement of Paz, Castro, and Palacio (28) regarding the ability of social entrepreneurs to innovate and turn their ideas into sustainable reality. 57% of Wayuu women almost always propose the formulation of projects for the well-being of the community, while 43% do so always. The average value for the planning indicator was 4.41, placing it in the very high presence category. These results are consistent with Shapero, cited in Ferrero and Ríos, (29), who describes the social entrepreneur as a planned person who organizes resources concretely to achieve specific goals.

In general analysis, Wayuu women entrepreneurs demonstrate a high level of presence in the evaluated qualities, with an average of 4.32. According to Cajina (30), a social entrepreneur is distinguished by their organizational capacity, which allows them to face new challenges and projects, surpassing previously reached limits. This reflects a robust ability to drive sustainable development and well-being in their communities. Furthermore, these findings align with the research of Gálvez and Suárez (31). The life experience of a female entrepreneur offers a deeper understanding of the challenges she faces daily, highlighting her distinctive qualities as an innovative, creative, and responsible woman. This experience provides a unique perspective that allows her to tackle challenges with a combination of ingenuity, originality, and commitment.

5. Conclusions

According to the results, the entrepreneurial qualities of Wayuu women were evident, revealing a profile that is put into practice in the social entrepreneurship of the communities under study. In this regard, they indicate a strong tendency of these women to seek alternatives to meet the needs of their community, demonstrating a significant presence in the creativity category, showing a constant ability to propose ideas that support the planned activities in their communities.

However, tolerance is another quality in these women, who collaborate in social activities, being responsible and visionary when taking control of activities and initiatives that lead to satisfying collective needs, participating in the formulation and implementation of projects aimed at the well-being of their communities. Thus, these tireless protagonists working for the common good are women with excellent organizational capacity, allowing them to face new challenges and projects, surpassing the limits previously reached.

6. Bibliography

- [1] Paz M, Prieto P. Entrepreneurship as a strategy in university education in Colombia. Proceedings of the IV Research Conference “Entrepreneurship and Managerial Innovation”. Maracaibo, October 16-17, 2015. Dr. Rafael Belloso Chacín Private University; 2015 [cited 2024 Jun 21]. Available from: <https://www.urbe.edu/investigacion/centros/Memoria-IV-Jornadasde-Investigacion-Emprendimiento-e-Innovacion-Tecnologica.pdf>
- [2] Calanchez U, Ríos MA, Zevallos RL, Silva FJ. Innovation and social entrepreneurship as a strategy to face the COVID-19 pandemic. *Rev Cienc Soc (Ve)*. 2022;28(1). Available from: <https://www.redalyc.org/articulo.oa?id=28069961020>
- [3] Ordoñez-Abril DY, Castillo-López AM, Rodríguez-Bravo IM. Women's empowerment in entrepreneurship and innovation. *Poblacion y Desarrollo*. 2021;27(52):69-91. <https://doi.org/10.18004/pdfce/2076-054x/2021.027.52.069>
- [4] Durán S, Fuenmayor A, Cárdenas S, Hernández R. Entrepreneurship as a process of social responsibility in higher education institutions in Colombia and Venezuela. *Desarrollo Gerencial*. 2016;8(2):58-75.
- [5] Barragán C, Salazar D, García J, Martínez H. Business creation in the Department of Atlántico based on the university-business-states strategy. In: Rincón Y, Restrepo J, Vanegas J, coords. Essential functions for the management of small

- and medium-sized enterprises. PYME Series. Vol. V. Medellín: Tecnológico de Antioquia University; 2020. p. 109-131.
- [6] Paz-Marcano, A., Castro-Alfaro, A., & Palacios-Rozo, J. (2019). Competencias del Emprendedor Social Aliado de las Comunidades del Entorno Empresarial Petrolero Venezolano. *Saber, Ciencia Y Libertad*, 14(2), 163-177. <https://doi.org/10.18041/2382-3240/saber.2019v14n2.5883>
 - [7] Saavedra García ML, Camarena Adame ME, Vargas Sáenz ME. An approach to the concepts of entrepreneur and social entrepreneurship. *Rev Univ & Empresa*. 2020;22(39):1-27. <https://doi.org/10.12804/revistas.urosario.edu.co/empresa/a.7976>
 - [8] Franco F, Prieto R, Paz A, Meslier D. Social entrepreneurship. In: Oliveros E, Barrios K, Acosta J, eds. *Business and inclusive perspectives: Social entrepreneurship. Opportunity scenario for Wayuu handicraft marketing and distribution SMEs*. Colombia: Universidad Simón Bolívar; 2017. p. 145-72.
 - [9] Meléndez Serpa S, Montoya Sanabria L, Vélez Restrepo A. Systematization of communicative practices in the community processes of Ediana Montiel Montiel [undergraduate thesis]. Medellín: Universidad de Antioquia; 2021
 - [10] Espinosa D, Gelvez C. The empowerment of women through Wayuu handicrafts: Case study of the Castellano Company [Internet]. 2017 [cited 2024 Jun 21]. Available from: <http://hdl.handle.net/10554/35978>
 - [11] Pineda Escobar MA, Falla Villa PL. Inclusive businesses as a source of quality work for poor women entrepreneurs: an exploratory study in the municipality of Apartadó, Colombia. *Equidad & Desarrollo*. 2016;25(1):179-208. <http://dx.doi.org/10.19052/ed.3529>
 - [12] Mesa-Rodríguez MC, Restrepo-Medina LP. Social change as a result of social innovation through participatory methodologies: a bibliometric review. *El Ágora USB*. 2020;20(1):50-65. [cited 2023 Nov 24]. Available from: <https://www.redalyc.org/articulo.oa?id=407764644003>
 - [13] Uribe-Toril J, De Pablo J, Ruiz-Real JL, Pires Manso JR. Scientific literature on social entrepreneurship and its impact in the Ibero-American context. *Rev Cienc Soc (Ve)*. 2019;25(3):10-29. Available from: <https://www.redalyc.org/articulo.oa?id=28060161001>
 - [14] Moreno, Z.; Parra, M.; Villasmil, M.; Hernández, B. & Durán, S. (2017). Importancia del Pensamiento Estratégico y Acciones Estratégicas para impulsar el emprendimiento social en las universidades venezolanas. *Espacios*, 38 (45), 4-16
 - [15] Guedez, V (2010) Responsabilidad social empresarial: visiones complementarias. Hacia un modelaje social. Venezuela. Editorial Alianza Social Venamcham. Primera edición.
 - [16] Curto, M (2012) Los emprendedores sociales: innovación al servicio del cambio social. España Enero 2012. Cuaderno 13. Editorial de la Universidad de Navarra
 - [17] Gabaldón J. Sustainable development. The way out for Latin America. Caracas: Grijalbo; 2006.
 - [18] Vainrub A. The social entrepreneur: a leader for change. Caracas: Fundación Venezuela Sin Límites; 2009.
 - [19] Drayton B. Cited by Soto E, Cárdenas J. Ethics in organizations. Mexico: McGraw-Hill Interamericana; 2007.

- [20] Siiger C. The daily life of Wayuu women in 2019 [thesis]. Bogotá: Uniandes; 2020. Available from: <http://hdl.handle.net/1992/43735>
- [21] Palella S, Martins F. Quantitative research methodology. Caracas: Editorial Fund of the Universidad Pedagógica Experimental Libertador (FEDUPEL); 2017.
- [22] Méndez C. Methodology: design and development of the research process. Bogotá: Limusa; 2013.
- [23] Hernández R, Mendoza C. Research methodology: the quantitative, qualitative and mixed routes. Mexico: McGraw Hill; 2018.
- [24] Hernández R, Fernández C, Baptista M. Research methodology. Mexico: McGraw Hill; 2014.
- [25] Arias F. The research project. 7th ed. Caracas: Editorial Episteme; 2016.
- [26] Paz U, Paz A, Estaba R, Burgos M. Reflections on the scientific research process. Santiago: Editorial Pragmatika; 2022.
- [27] Soto E, Cárdenas J. Ethics in organizations. Mexico: McGraw-Hill Interamericana; 2007.
- [28] Paz-Marcano A, Castro-Alfaro A, Palacios-Rozo J. Competencies of the social entrepreneur allied with the communities of the Venezuelan oil business environment. *Saber, Ciencia y Libertad*. 2019;14(2):163-77. <https://doi.org/10.18041/2382-3240/saber.2019v14n2.5883>
- [29] Ferreiro, F y Ríos, D (2014) El concepto de emprendedor y la empresa familiar. 4ª Conferencia Ibérica de Emprendimiento. Pontevedra, España 23 al 26 de octubre de 2014.
- [30] Cajina, G (2014) Coaching para emprender. Cambia tu rumbo, despide a tu jefe. México. Ediciones Díaz de Santos.
- [31] Gálvez-García, R., & Suárez-Ortega, M. (2021). Mujeres emprendedoras. Experiencias vividas a partir de historias de vida. *Revista De Estilos De Aprendizaje*, 14(Especial), 89-99. <https://doi.org/10.55777/rea.v14iEspecial.3690>

Strategy according to its strategist, how entrepreneurs from the regions of Araucanía and Biobío think about their business action plan

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Abstract

The strategy of SMEs has been widely researched, emphasizing that the entrepreneur's vision is an important factor. This study examines how entrepreneurs from the regions of La Araucanía and Biobío (Chile) perceive their personal characteristics and technical skills in relation to business strategy. A qualitative approach was used, including a case study, and 92 in-depth interviews were conducted. The methodology involved open and axial coding, identifying two main categories: organizational development and business development, with nine subcategories: adaptability, customer service, growth, success, financial key, skills, marketing, and emotions. The results indicate that adaptability is key to practical leadership and that customer service is considered a decisive factor for future success. Organizational development is linked to internal leadership capabilities, while success is related to the personal characteristics of the entrepreneur. Financial management is important for long-term stability and growth, and social skills such as resilience help to overcome challenges. The findings highlight the importance of an integrated approach that combines flexibility and leadership development to foster continuous improvement and adaptation. The resilience and

motivation of business leaders are essential to solving problems and driving growth. Effective marketing, customer service, and financial management form the foundation of competitiveness and long-term stability. The interconnection and complementarity of categories and subcategories create an integrated framework that ensures operational efficiency and strategic effectiveness, supporting the continued success and growth of small and medium-sized enterprises in a dynamic business environment.

Keywords: organizational development, Entrepreneurial Growth, leadership, strategy.

JEL Rating: M10

1. Introduction

The strategy in SME ventures has been studied from various points of view, they analyze 5 different types of strategic behaviors among which the vision of the entrepreneur is considered as key. This coincides with what was found by Klewitz & Hansen (2014)[1] Kreiser et al. (2013)[2] those who report only three behaviors. Among the highlighted behaviors are considered leadership, intuition and resilience. These behaviors are shown above all in decision-making and in how to face the markets.

W. Li et al. (2016)[3], explain that leadership helps in strategic management and that this aligns entrepreneurship in a direction, while considering the effect this has on a globalized and changing economy. In this way Thornsri & Pila-Enigma (2023)[4], leadership becomes a required behavior for the strategist in charge.

On the other hand, intuition shows certain positive patterns [5], when the entrepreneur can foresee the future with some clarity, which tends to be something that develops over time. There are also possibilities that intuition plays against them [6], if the entrepreneurs are new to the area or if their technical specialty is very high (dentists, mechanics, engineers) and is not related in some way to the market.

Regarding resilience Roffia & Dabić (2024)[7], they explain that this capacity allows companies to overcome bad times, such as the recent COVID-19. This characteristic would also allow entrepreneurs to better manage their emotions regarding entrepreneurship [8] .

This places us in the role that the entrepreneur should have in the strategy and management of the SME and allows us to anticipate what the personal characteristics of the entrepreneur could be.

However, something that needs to be internalized is how they see the technical parts of the strategy, such as the financial and commercial area of the strategy.

Within this topic Bellamy (2009)[9], he explains that, in general, SMEs tend to see the financial area more as a daily tool than a long-term one, for their part Gao et al. (2020)[10], they present how this can trigger medium and long-term problems.

Within the commercial variables Yoo & Jung (2024)[11], they explain the failure variables in Research Development (DR) strategies in small and medium-sized companies, as well as Majláth et al. (2019) [12] use the gender approach to explain the different decisions and how they can affect them.

Finally Cheffi et al. (2021)[13], it relates the structure of the company to innovation and how this can affect the development linked to what is presented by Chang & Hughes (2012)[14] and the duality of the entrepreneur as innovator and strategist. We must consider that every managerial function in SMEs has, due to its condition and size, a role beyond that of administrator [15].

Considering these two general aspects, characteristics of the entrepreneur and their relationship with administrative techniques, it is seen that there is an unexplored part, and that is how the entrepreneur himself sees his characteristics and technical skills to face the market in which he finds himself.

2. Methods

The present research is carried out through a qualitative approach, to understand how participants perceive events [16,17]. On the other hand, the design corresponds to a Case Study [18,19], since it seeks to describe the reality that SME entrepreneurs live in and its relationship with the strategy.

This approach is linear in nature [20], bearing in mind using guiding categories to be investigated [21]. The method of this research is hypothetical-deductive [22].

The geographical area of the study considers SMEs in the regions of La Araucanía and Biobío, in Chile. The total number of interviews conducted was 92.

The collection method used was an in-depth interview [23], this method allows us to obtain specific and experiential information from the interviewee. And its validity was tested by the triangulation method [24].

As an analysis tool, we worked with Atlas.ti for the analysis of categories and construction of figures [25].

Discussion of results

From the process of open and axial coding, the categories emerge: Organizational Development and Entrepreneurial Growth, of which nine subcategories are part:

1. Adaptability
2. Customer Service
3. Development
4. Success
5. Finance
6. Skills
7. Marketing
8. Feelings

It should be noted that these categories and sub-categories were mostly saturated considering the objective set

Category: Organizational Development

From this category, subcategories are generated that refer, mainly, to the technical factors [26] for the commercial success of the company.

Entrepreneurial Growth Category

From this category arise the subcategories that refer to the soft skills [27] of the leaders of the organization.

Subcategory Adaptability

This subcategory is the one with the highest frequency of coding, and refers, in general, to how the practical functioning of leadership in entrepreneurship is: *“The truth is that since I am the owner, I am always open to innovation and I adapt, since I am constantly seeing and informing myself of how to improve my company, see what my competition is doing in order to apply it”* (E.3), In this same idea, another interviewee describes this as follows: *“Our main advantage is that we adapt to the needs of our customers by lying to them satisfied with our products, which strengthens us as an SME, and maintains a good reputation.”* (E. “27).

In the words of Sarta et al. (2021)[28], *“adaptation is intentional, relational, conditioned, and convergent. Thus, we go beyond the dictionary definitions”* (p. 67), this shows how entrepreneurs seek to make a space for themselves and adapt their immediate reality to the specific and changing needs of the environment.

Customer Service Subcategory

In this category we can see how entrepreneurs link the future success of the organization by keeping satisfied customers, in relation to this we can see this as a perspective of clarity within management, this is clear in the following literality [29,30]: *“Decisions are made, depending on the moment and magnitude of the problem, always looking for the best and most feasible for the customer.”* (E.21)

Cevallos Veintimilla et al. (2018) , explain in relation to this, that every business decision must be aimed at meeting the need that the customer has, although this does not necessarily imply fulfilling their desire, but in relation to the real capabilities of the customer, as well as the company [32].

Development Subcategory

This category is linked to the development of internal leadership in the organization and how entrepreneurs have been leading the development in the organization, this is how we see that they seek [33] *“To achieve the goals that have been proposed and those that are emerging and improving quality and seeking growth”* (E.75) or *“Our decisions are based on the well-being of what we have already achieved but always promoting new machinery, quality cuisine, etc., we want to stay well without leaving growth aside.”* (E.44).

This agrees with the findings of Day et al. (2014)[34] those who make a synthesis of 2 years of study and describe the emotional importance of dealing and preparation for the future.

Subcategory Success

Leadership has long been associated with the success or failure of an organization. A good leader has certain characteristics that contribute to desirable or undesirable organizational results [35] , so we can see that entrepreneurs associate this with their own behaviors:

“Our goal is to be one of the best bars in the region, that people prefer us over others and my vision for the future is to move forward step by step, in the same way as we are doing it and because of the results we have had, we are on the right track” (E.53)

The personal factors of entrepreneurs show their strengths when choosing a business career. They also effectively balance their personal and professional lives, which helps them stay strong. They also tend to pass on proven experiences to the next generations so that they can implement them and achieve success in their ventures [36].

Subcategory Finance

The complexity of the financial environment in SMEs and new companies tends to be a major stumbling block in their development [37], this is something that the entrepreneurs of the study seem to be completely clear, as we can see in this literality:

“Monthly I save money for some mechanical eventuality and also to expand my company by buying one more vehicle or renewing vehicles that we already have, making improvements in the mechanical part as well as in the comfort part.” (E.1)

This is how the financial management of emergencies and the economy denote a key importance in the development of the company and its future success

Subcategory Skills

The personal skills of entrepreneurs help in the development of the company [38], so we can find several attitudes of the entrepreneurs in which this is reflected: *"At the beginning it is more difficult, since when starting the SME one seeks help to raise capital, that was the main challenge since not even the State granted me help, y junto a mi socia solas sacamos nuestro negocio adelante"*, (E.4).

This literal statement shows us the capacity for resilience and self-motivation that entrepreneurs have been developing and how this has helped them to stay on the path to success.

Marketing Subcategory

Marketing, as such, describes many actions and characteristics of the environment [39], which is why this subcategory groups together various codes such as those related to the study of the consumer [40] in relation to their food preferences: *"The truth is that the market is not so variable even when trying to integrate new flavors, but the public is reluctant to new things, has had to adapt to the tastes of customers"* (E.12), segmentation [41]: *"Market segment selection is based on income, preferences, location, demand, and competition."* (E.9) and delivering value to the market (42):

"SMEs agree on an ambitious and realistic vision. It is recognized that regional expansion requires significant investment, but also that there is a market opportunity, and its value proposition must continue to develop. Se debe investigar las necesidades y preferencias de los consumidores de la región de la Araucanía para identificar nuevas oportunidades de innovación" (E.26)

The importance of the risks that the company decides to take varies according to its perception of the markets [43], so we can see that for entrepreneurs an important part of the future of their business is given precisely by how they are able to relate these variables [44] to each other and bring them to fruition.

Subcategory Feelings

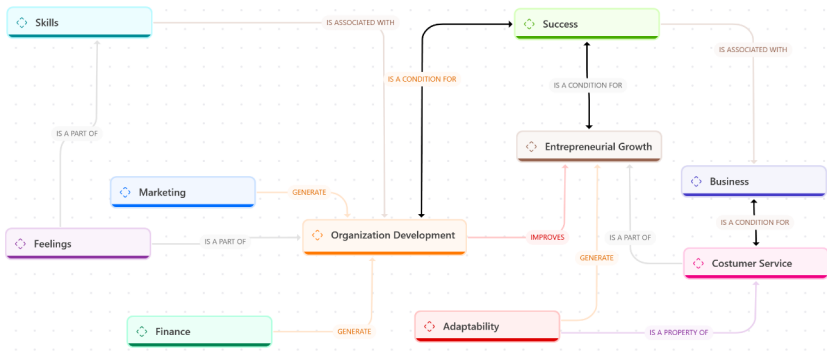
The way entrepreneurs understand their business involves a specific emotional connection [45], which is why this can be very relevant

when making decisions [46]: “Our decisions are based on the well-being of what we have already achieved, but always promoting new machinery, quality cuisine, etc., we want to stay well without leaving growth aside” (E.16).

The ability of entrepreneurs to develop feelings of affection towards their company (8) is a double-edged sword [47] because it can lead to bad decisions due to the development of attachment.

The relationship between the various categories and subcategories can be seen in Figure 1, where you can see how the concepts already explained are reinforced

Figure 1: Category Network.



Note: own elaboration with data collected

It highlights how entrepreneurs consider that their development as entrepreneurs affects both the development of the company and its growth, understanding that for them growth is in relation to market spaces and development in terms of the internal part of the company.

The other thing that stands out is that for them success is not the result of their activity but is part of it as it is a reciprocal condition.

The distribution of phrases referring to each code and subcode can be seen in Figure 2 below.

Figure 2: Sankey Graph with Co-Occurrence of Codes.



Note: own elaboration with data collected

The first thing we notice is that the subcategories are not exclusively integrated into one or the other category; This is because there are specific concepts that are related in one way or another, or that respond to more than one idea.

3. Conclusions

The analysis emphasizes that the categories of organizational development and Entrepreneurial Growth are closely related and are very important for the overall success of ventures. The ability to continuously adapt and evolve is critical to driving innovation and continuous improvement. In addition, customer service and financial management are important to maintain customer satisfaction and financial stability, thus facilitating future growth.

An entrepreneur's personal skills, such as resilience and motivation, play an important role in overcoming challenges and achieving success. These elements work together to strengthen the company's competitive position and sustainability in the market.

An integrated approach, where agility and internal leadership development are key elements, enables organizations to continuously

improve and adapt to changing market requirements. The resilience and motivation of business leaders are essential to solving problems and driving growth.

Marketing, customer service, and effective financial management are the pillars that underpin long-term competitiveness and financial stability. The synergy of these elements creates a strong and flexible strategy that ensures long-term success and continued growth of the company.

Finally, we observe that the interconnectedness and complementarity of the organizational development and Entrepreneurial Growth subsections create an integrated structure that ensures operational efficiency and strategic effectiveness. This comprehensive approach not only enhances the company's ability to innovate and meet customer needs but also ensures the company's stability and growth in a dynamic business environment.

4. Bibliography

- [1] Klewitz J, Hansen EG. Sustainability-oriented innovation of SMEs: A systematic review. Vol. 65, *Journal of Cleaner Production*. 2014. p. 57–75.
- [2] Kreiser PM, Marino LD, Kuratko DF, Weaver KM. Disaggregating entrepreneurial orientation: The non-linear impact of innovativeness, proactiveness and risk-taking on SME performance. *Small Business Economics*. 2013 Feb 1; 40(2):273–91.
- [3] Li W, Liu K, Belitski M, Ghobadian A, O'Regan N. e-Leadership through strategic alignment: An empirical study of small- and medium-sized enterprises in the digital age. *Journal of Information Technology*. 2016 Jun 1; 31(2):185–206.
- [4] Thornsri P, Pila-Ngarm P. ROLES OF EFFECTIVE LEADERS IN SMALL AND MEDIUM-SIZED ENTERPRISE MANAGEMENT UNDER THE GLOBAL ECONOMIC CRISIS. *Polish Journal of Management Studies*. 2023 Dec 21; 28(2):349–66.
- [5] Centeno E, Cambra-Fierro J, Vazquez-Carrasco R, Hart SJ, Dinnie K. The interplay between SME owner-managers and the brand-as-a-person. *Journal of Product and Brand Management*. 2019 Jul 17; 28(4):555–72.
- [6] Wee JCN, Chua AYK. The peculiarities of knowledge management processes in SMEs: The case of Singapore. *Journal of Knowledge Management*. 2013; 17(6):958–72.
- [7] Roffia P, Dabić M. The role of management control and integrated information systems for the resilience of SMEs. *Review of Managerial Science*. 2024 May 1; 18(5):1353–75.
- [8] Hadiyanto HS. Strategic flexibility and consistency at manager level: the compatibility between strategic enforcement and personality traits. *Asian Academy of Management Journal*. 2023 Dec 6; 28(2):119–46.

- [9] Bellamy LC. Strategy formulation in SMEs: indications from a longitudinal study. Vol. 8, Int. J. Entrepreneurship and Small Business. 2009.
- [10] Gao X, Jia Y, Li S. Does Mandatory Disclosure of Internal Control Weaknesses Affect Corporate Financing Decisions? *Journal of Accounting, Auditing and Finance*. 2020 Jul 1; 35(3):581–606.
- [11] Yoo HS, Jung YL. The Effect of the Commercialization Failure of SMEs' R&D on Survival. *IEEE Trans Eng Manag*. 2024; 71:6078–89.
- [12] Majláth M, Kelemen-Erdos A, Valocikova C. Understanding SME's failure - Focus on success factors and gender differences: Comparative analysis of SME's in Czech Republic, Hungary and Serbia. *Serbian Journal of Management*. 2019; 14(2):327–44.
- [13] Cheffi W, Abdel-Maksoud A, Farooq MO. CSR initiatives, organizational performance and the mediating role of integrating CSR into management control systems: Testing an inclusive model within SMEs in an emerging economy. *Journal of Management Control*. 2021 Sep 1; 32(3):333–67.
- [14] Chang YY, Hughes M. Drivers of innovation ambidexterity in small- to medium-sized firms. *European Management Journal*. 2012 Feb; 30(1):1–17.
- [15] Chang YY, Hughes M, Hotho S. Internal and external antecedents of SMEs' innovation ambidexterity outcomes. *Management Decision*. 2011 Nov; 49(10):1658–76.
- [16] Álvarez-Gayou Jurgenson JL. How to do qualitative research. A. EPaIS, editor. Barcelona; 2009. 214 p.
- [17] Sáenz López K, Tamez González G. Qualitative and Quantitative Methods and Techniques Applicable to Research in Social Sciences [Internet]. Mexico City: Editorial Tirant Humanidades; 2015. Available from: <https://editorial.tirant.com/mex/libro/metodos-y-tecnicas-cualitativas-y-cuantitativas-aplicables-a-la-investigacion-en-ciencias-sociales-antonio-lopez-pelaez-9788416062324>
- [18] Arias FG. The Research Project. 6o. Caracas: Editorial Episteme, C.A.; 2012. 137 p.
- [19] Reis HT, Judd CM. Handbook of Research Methods in Social and Personality Psychology. یشزرو بٹ. 2000.
- [20] González-Díaz RR, Acevedo-Duque ÁE, Guanilo-Gómez SL, Cruz-Ayala K. Qualitative Research Route – Naturalist: An Alternative for Management Studies. *Journal of Social Sciences (RCS)* [Internet]. 2021 [cited 2024 Jun 11]; XXVII(4):334–50. Available from: <https://produccioncientificaluz.org/index.php/rcs/index>
- [21] Hernández Sampieri R, Fernández Collao C, Baptista Luco P. Research Methodology. 6th Mexico City: McGRAW-HILL / INTERAMERICANA EDITORES, S.A. DE C.V.; 2014. 634 p.
- [22] Gibbs G. The analysis of qualitative data in Qualitative Research (Spanish Edition). Madrid Ediciones Morata, S. L.; 2012.
- [23] Taylor SL, Bogdan R. Introduction to qualitative research methods [Internet]. Barcelona: Paidós; 1987. 343 p. Available from: <https://eugenia.wagner.files.wordpress.com/2012/08/taylor-bogdan-intr-met-cuali-1.pdf>
- [24] Okuda Benavides M, Gómez Restrepo C. Methods in qualitative research: triangulation. *Rev Colomb Psiquiatr*. 2005; 34(1):118–24.

- [25] Lopezosa C, Codina L, Freixa P. ATLAS.ti for semi-structured interviews: a user guide for an effective qualitative analysis [Internet]. Barcelona; 2022 Apr [cited 2024 Jun 11]. (Digidoc). Report No.: 4. Available from: www.upf.edu/web/digidoc/
- [26] Kwilinski A, Kuzior A. Cognitive Technologies in the Management and Formation of Directions of the Priority Development of Industrial Enterprises. Management Systems in Production Engineering. 2020 Jun 1; 28(2):133–8.
- [27] Hernandez Abad G. Management of emotions in times of pandemic and its impact on academic performance. “UCV HACER” Journal of Research and Culture - César Vallejo University. 2021; 9(9):10.
- [28] Sarta A, Durand R, Vergne JP. Organizational Adaptation. J Manage. 2021 Jan 1; 47(1):43–75.
- [29] Al Awadhi Ja, Obeidat B, Turki Akshurideh M. The impact of customer service digitalization on customer satisfaction: Evidence from telecommunication industry. International Journal of Data and Network Science. 2021 Sep 1; 5(4):831–6.
- [30] Hsu CL, Lin JCC. Understanding the user satisfaction and loyalty of customer service chatbots. Journal of Retailing and Consumer Services. 2023 Mar 1;71.
- [31] Cevallos Veintimilla AF, Baquero Landeta CD, Lema Lliguicota LF, Vera Campuzano NR. Consumer Psychology [Internet]. Guayaquil: Ediciones Grupo Compás; 2018 [cited 2022 Dec 14]. 75. Available from: <http://142.93.18.15:8080/jspui/bitstream/123456789/460/1/Guia%20de%20psicolog%c3%ada%20del%20consumidor.pdf>
- [32] Herrera, Perez AP. Communication as a key factor in the consumer experience for pricing. aDResearch ESIC International Journal of Communication Research. 2020 Jan 1; 21(21):84–97.
- [33] Mccauley CD. Leader Development: A Review of Research [Internet]. Greensboro; 2008 Sep [cited 2024 Jun 9]. Available from: https://www.researchgate.net/profile/Cynthia-Mccauley/publication/266495919_Leader_Development_A_Review_of_Research/links/54ec89f90cf2465f532f980c/Leader-Development-A-Review-of-Research.pdf
- [34] Day D V, Fleenor JW, Atwater LE, Sturm RE, McKee RA. Advances in leader and leadership development: A review of 25 years of research and theory. Leadership Quarterly. 2014 Feb; 25(1):63–82.
- [35] Tiwari H, Raman R. Success attributes of business leaders from information technology industry: Evidence from India. International Journal of Information Management Data Insights. 2022 Apr 1; 2(1):100083.
- [36] Machani P, Lakshman Kumar Y. Study on Critical Success Factors Leading Entrepreneurs to Success: Reference to Micro entrepreneurs, Secunderabad. [cited 2024 Jun 9]; Available from: <https://www.researchgate.net/publication/373019544>
- [37] Ahinful GS, Boakye JD, Osei Bempah ND. Determinants of SMEs’ financial performance: evidence from an emerging economy. Journal of Small Business and Entrepreneurship. 2023; 35(3):362–86.
- [38] McIntyre P, Fulton J, Kerrigan S, Meany M. Entrepreneurship in the Creative Industries How Innovative Agents, Skills and Networks Interact. 2023.

- [39] Kotler P, Keller K Lane. Marketing Management. 14th ed. Naucalpan de Juárez, Mexico: Prentice Hall; 2014. 810 p.
- [40] Tarabella A, Burchi B. The Role of Nutrition and Health Claims in Consumers' Perception. Creating Educational Paths to Resolve Information Asymmetries Caused by Promotion and Marketing Activities Regarding Foodstuffs. *Proceeded Soc Behav Sci* [Internet]. 2012; 46(1169):2173–7. Available from: <http://dx.doi.org/10.1016/j.sbspro.2012.05.449>
- [41] Bonjean I. Heterogeneous incentives for innovation adoption: The price effect on segmented markets. *Food Policy* [Internet]. 2019; 87(July):101741. Available from: <https://doi.org/10.1016/j.foodpol.2019.101741>
- [42] Nowotny S, Hirsch B, Nitzl C. The influence of organizational structure on value-based management sophistication. *Management Accounting Research*. 2022 Sep 1;56:100797.
- [43] Covin JG, Garrett RP, Bouncken RB, Ratzmann M, Muhammad M. Core business prospects and the management of internal corporate ventures. *Small Business Economics*. 2024 Jan 1; 62(1):435–59.
- [44] Fang E, Palmatier RW, Steenkamp JBE. Effect of Service Transition Strategies on Firm Value. *J Mark*. 2008; 72:1–14.
- [45] Uy MA, Foo Management MD, Aguinis H. Using Experience Sampling Methodology to Advance Entrepreneurship Theory and Research. 2009.
- [46] Li Y. Emotions and new venture judgment in China. *Asia Pacific Journal of Management*. 2011 Jun; 28(2):277–98.
- [47] Craft JL, Shannon KR. An examination of the 2012–2022 empirical ethical decision-making literature: A quinary review. *Business Ethics, the Environment and Responsibility*. 2024; 34(3):701–721. <https://doi.org/10.1111/beer.12676>

The importance of efficiency and sustainability in water consumption in the context of the Sustainable Development Goals: a proposed regional composite indicator

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Abstract

This paper highlights the importance of accurately quantifying water usage, a valuable and limited resources-, especially in climate change and extreme events such as prolonged droughts. UNESCO warns that climate alterations will affect the availability, quality, and quantity of water needed to meet basic human needs. The study uses current methodologies to quantify the water required in supply chains and assess its sustainability, aligning with United Nations Sustainable Development Goal 6: “Clean and sanitary water for all”. It analyses the role of water in a globalised market, emphasising responsible consumption, waste

recycling and circular practices among different stakeholders. In this context, the water footprint provides information on the volume of water used in production processes, identifying its sources and evaluation mechanisms. The study also proposes a composite indicator to assess the efficiency of sustainable water use in Spain's Autonomous Communities, considering variables such as consumption and pollution from human activities, particularly in the agricultural, industrial and domestic sectors.

Keywords: Water economy, water footprint, SDGs, sustainability, indicators.

1. Introduction¹

Access to water is a fundamental right, recognized by the UN, and is key to sustainable development. However, its availability and quality are increasingly threatened by factors such as population growth, climate change, and the overexploitation of resources, affecting two-thirds of the world's population and compromising economic and social stability [1,2].

In the 21st century, humanity faces a severe water crisis. UNESCO has already warned that “the real tragedy of this crisis is its effect on the daily lives of poor populations, who bear the brunt of water-related diseases, live in degraded and often dangerous environments, struggle to educate their children, earn a living, and meet their basic nutritional needs” [3].

The International Water Resources Association (IWRA) asserts that the crisis is not only due to scarcity but also to unequal and inefficient distribution. Contributing to this are consumerist lifestyles, urbanization, the industrialization of emerging economies, and population growth, alongside climate change, deforestation, and greenhouse gas emissions. UNESCO points out that climate changes will affect the availability, quality, and quantity of water needed to

¹ The authors are affiliated with the UNESCO Chair “Water and Peace” at the Spanish universities UNED and URJC (<https://blogs.uned.es/catedraunesco-aguaypaz/>). They wish to pay tribute to the memory of Samuel Crespo Fernández, a graduate in Law and Business Administration and Management from the Autonomous University of Madrid, whose Final Degree Project, directed by Professor Ana M. López, has provided the inspiration for this work.

meet basic human needs. Therefore, the water crisis must be addressed from a broad perspective of problem and conflict resolution.

In a context of extreme phenomena such as storms, droughts, ecosystem loss, or epidemics, it is crucial to properly quantify water use. Recognizing and expressing its value and integrating it into decision-making is essential for equitable and sustainable management [4].

This chapter addresses this need by highlighting tools to quantify the water required in supply chains, assess its sustainability, and understand its role in achieving SDG 6: “Clean water and sanitation for all.” Achieving the SDGs depends on the progressive improvement of healthy freshwater systems. Although renewable, water is a finite and irreplaceable resource that requires efficient management to strengthen the resilience of economic, social, and environmental systems in the face of unpredictable scenarios [5, 6, 7].

Among the highlighted goals are those established in the Post-2015 Water Agenda of UN-Water [8] the inter-agency mechanism for issues related to freshwater and sanitation:

- Achieve universal access to safe drinking water, sanitation, and hygiene.
- Improve the sustainable use and development of water resources in all countries.
- Strengthen equitable, participatory, and accountable water governance.
- Reduce water pollution and improve water quality by reducing untreated domestic and industrial wastewater.
- Reduce mortality and economic losses from water-related natural disasters.

Despite growing social awareness and existing policies, major barriers persist ineffective institutional frameworks, geopolitical inequalities, tense international relations, and resistance from certain industrial sectors to modify their processes. [9, 10]. In addition, inequalities in water access worsen issues such as poor sanitation, decreased agricultural production, and food insecurity. Increasing climate variability exacerbates these challenges.

UNESCO [11] emphasizes that better water management is essential to eradicating poverty. Thus, the water issue is central to the international debate due to its connection with multiple dimensions of inequality. These situations, closely linked to the hydrological cycle, underscore the urgent need for an appropriate valuation of the resource. An economic analysis is needed to prioritize sustainability programs, define trade-offs, design climate budgets aligned with international commitments, apply environmental fees, and provide clear references for policymaking [12,13]. Developing technical and decision-making capacities is a priority to generate knowledge and guide action. Likewise, it is crucial to implement adaptation policies based on effective communication of data. According to the Water Institute, water management involves the planning, development, and distribution of the resource based on efficiency, equity, and sustainability criteria.

Water sustainability must also be financial, implying recovery of the real costs associated with supply and treatment. Given the scarcity and value of the resource, economics must be incorporated into the study of rational decision-making within an integrated water management framework [14].

The urgency of moving toward efficient water management aligns with the principles of SDG 6. Inefficient or commodified management can exacerbate inequalities and jeopardize future sustainability. According to [15], between 2015 and 2018, global water use efficiency increased by 10%, especially in the industrial and service sectors, while agriculture continues to show the lowest efficiency levels. However, many countries lack reliable data and updated methodologies, highlighting the need to strengthen monitoring systems.

In this global scenario, analysing the role of water in an increasingly interdependent economy is particularly relevant. Responsible consumption, recycling, and the circular economy are valued as key strategies. Efficiency and sustainability in water use are central to achieving more equitable and resilient water management. The Water Footprint (WF) is becoming a consolidated tool for measuring the volume of water used in production processes, classifying its sources (green, blue, and grey), and enabling assessments at the level of consumers, companies, or territories, such as river basins. This

facilitates linking these concepts to the targets of SDG 6. Water is a strategic asset, but also an economic and social one. Its efficient and equitable management is essential to ensure the well-being of current and future generations.

Finally, a composite indicator is proposed, based on economic, social, and environmental variables, to analyse water use efficiency in Spain's Autonomous Communities. This tool facilitates territorial comparisons and contributes to the design of more effective policies.

2. Theoretical Framework

2.1. The Role of Water in the 2030 Agenda as a strategic resource

Water is an essential resource not only for life but also for economic growth, social stability, and environmental conservation. It is fundamental to all ecosystems, both aquatic and terrestrial, but is subject to high competition among users. The quantity and quality of water resources determine the type of ecosystem and the services it can provide—provisioning, regulating, supporting, and cultural [16]. Various factors exert pressure on or influence natural ecosystems and affect their productivity. These include population growth, accelerated urbanization and migration; changes in consumption patterns; economic growth; food insecurity and poverty; increased waste; natural disasters and conflicts; as well as the effects of climate change, already evident because of human activity [17]. In addition, there is growing tension over scarce water resources and the impact of policies from other sectors such as energy, industry, economy and finance, trade, and agriculture.

Although the total amount of water on the planet remains relatively stable, its distribution varies. About 97.5% of Earth's water is in oceans and seas, while only 2.5% is freshwater. Of this portion, 69% is stored in polar regions and mountain peaks, 30% in aquifers and soil moisture, and only 1% circulates through rivers and watersheds, accumulating in lakes, lagoons, reservoirs, and other surface water bodies, replenished through the hydrological cycle. This

limitation makes freshwater a highly vulnerable resource at risk of overexploitation.

Regarding the planet's water balance, only 0.007% of freshwater is available for direct human consumption [18]. This tiny portion supports crucial economic and social processes such as domestic consumption, irrigation, energy production, and industrial uses. Although this amount would be sufficient to ensure the survival of all living beings, temporal and geographic availability problems, disruptions to natural water flows, and ecosystem changes challenge humanity's capacity to manage the resource in an orderly, equitable, and sustainable way.

In this context, it can be stated that freshwater resources are increasingly threatened and at risk. [19] identify the main global pressures on water supplies as demographic changes, industrial development, rising living standards, and inadequate land use and water management policies. In fact, both the quantity and quality of surface and groundwater resources are significantly threatened in regions experiencing water stress [20], leading to a reduction in freshwater reserves.

From an economic perspective, water holds strategic value as a critical input in agriculture, industry, and energy production. The interdependencies of international trade have led some countries to rely on imports of goods whose production requires large volumes of water, creating imbalances in global water availability. This is evident in regions where water scarcity affects access to sanitation services, agricultural production, and food security. Trade globalization creates opportunities to enhance productivity and overall water use efficiency. As [9] note: "understanding the virtual water flows entering and leaving a country or river basin can reveal the real water situation of the country or basin in question." In this regard, from a territorial perspective, water pricing policies and volumetric and economic accounting of water resources become important.

The economic impacts of water are widely documented. [21] report that between 1980 and 2020, the likelihood of alternating droughts and torrential rains has increased, affecting agricultural production and economic stability. The World Bank warns of growing pressure on water resources driven by population growth—which

demands more food production—and climate change, which disrupts hydrological cycles. This situation could lead to a 40% gap between water demand and available resources by 2030, especially in poorer countries. Moderate droughts reduce economic growth in developing countries by 0.39 percentage points, while extreme droughts can reduce it by up to 0.85 percentage points [22]. Furthermore, climate-related disruptions compromise financial stability. The NGFS Network for Greening the Financial System estimates that droughts could cause losses of up to €32.7 trillion between 2020 and 2050, increasing the fiscal burden and public debt [23].

In the context of climate change, water security is a growing challenge. As a strategic resource, water must be managed with sustainability, equity, and efficiency criteria, ensuring its responsible use and long-term preservation. Efficient water management is key to balancing economic growth, social equity, and environmental sustainability. Measuring water efficiency is not only an economic concern but also an ethical and social imperative aligned with the SDGs, especially SDG 6, which promotes the availability and sustainable management of water and sanitation for all.

2.2. The Relationship Between Water (SDG 6) and Other SDGs

Access to safe drinking water and sanitation has historically been a global challenge. For centuries, the lack of infrastructure to separate potable and wastewater caused epidemics and diseases that limited the development of societies. It wasn't until the 19th century that sewer and water treatment systems began to be implemented, reducing mortality and improving life expectancy. However, this progress has not been globally equitable [24].

Despite advancements in developed countries, millions of people still lack access to safe drinking water and basic sanitation, which hinders their social and economic development. In 2010, the UN General Assembly recognized access to water and sanitation as a fundamental human right, urging governments and international organizations to adopt more inclusive and sustainable water policies.

Within the framework of the 2030 Agenda, the UN formulated SDG 6: “Ensure availability and sustainable management of water and sanitation for all.” Its goal is to close the gap in access to clean and safe water, improve sanitation infrastructure, and protect freshwater ecosystems. To achieve this, four fundamental principles have been established:

- a) separating drinking water from wastewater, ensuring sanitation infrastructure that reduces disease transmission and improves living conditions.
- b) facilitating access to safe drinking water and treating it adequately, ensuring its availability for human consumption and reducing the time and effort needed to obtain it.
- c) protecting and restoring freshwater ecosystems, preventing pollution and overexploitation of rivers, lakes, and aquifers, which are fundamental for water sustainability.
- d) safeguarding access to water and the right to use it, establishing fair agreements among different sectors (agriculture, industry, local communities, and the environment) to ensure responsible use of the resource.

Implementing the SDGs requires a global partnership involving active participation from governments, civil society, the private sector, and the United Nations system. These goals, with measurable targets and indicators, are indivisible and action oriented. SDG 6 and its link to the 2030 Agenda are closely connected to human rights to water and sanitation. The goal is to monitor and promote more sustainable practices to address water scarcity and ensure its availability (Table 1).

Table 1: Relationship Between Water (SDG 6) and the Sustainable Development Goals.

1 NO POVERTY 	←Water and sanitation reduce vulnerability and improve family income (**) 		(**) Water and sanitation are key to the social and economic inclusion of the poorest→ 	10 REDUCED INEQUALITIES 
2 ZERO HUNGER 	←Water is key for agricultural productivity and food processing (**) 		(*) Deaths and economic losses from water-related disasters→ 	11 SUSTAINABLE CITIES AND COMMUNITIES 
3 GOOD HEALTH AND WELL-BEING 	←Waterborne diseases. Deaths caused by water pollution (*) 	6 CLEAN WATER AND SANITATION 	(*) Water pollution from chemicals and waste→ 	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 
4 QUALITY EDUCATION 	←Water and sanitation improve academic performance (**) 	(*) Goals that specifically mention water (**) Relationships with water and sanitation 	(**) Water is key to adaptation to climate change and the resilience of people, economic activities, and ecosystems→ 	13 CLIMATE ACTION 
5 GENDER EQUALITY 	←Water and sanitation rights are violated, especially among women and girls (**) 		(**) Reducing marine and coastal pollution requires improvements in water quality→ 	14 LIFE BELOW WATER 
7 AFFORDABLE AND CLEAN ENERGY 	←Energy production is highly dependent on water (**) 		(*) Inland freshwater ecosystems and wetlands: Effects of invasive species on aquatic ecosystems→ 	15 LIFE ON LAND 

8 DECENT WORK AND ECONOMIC GROWTH 	←Water and sanitation increase labour productivity and economic growth (**)		(**) Importance of collaboration between regions and countries that share water resources to avoid conflicts→	16 PEACE, JUSTICE AND STRONG INSTITUTIONS 
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	←Water and sanitation are spaces for innovation and key for industry. The importance of infrastructure (**)		(**) The relationship between water and all the objectives makes it a key area for fostering partnerships and cooperation→	17 PARTNERSHIPS FOR THE GOALS 

Source: own elaboration adapted from [25].

2.3. Efficiency and Sustainability in Water Consumption

Approximately one fifth of the world's population lives in areas experiencing physical water scarcity. As a limited and irreplaceable resource, water can only be considered renewable if it is well managed. Despite increasing recognition of the need for sustainable water management and multiple international initiatives, significant barriers remain [26, 27]. Among the main obstacles to efficient resource management are:

- Economic and geopolitical factors, which influence investment in water infrastructure and the implementation of efficiency strategies.
- Institutional and legislative frameworks often misaligned with a sustainable management approach.
- Interests of certain productive sectors, which sometimes resist adapting their processes to optimize water use.

In this context, it is key to consider water stress levels across different countries, as these are likely to increase with population growth and the effects of climate change. Physical water stress is defined as the percentage of total freshwater withdrawn annually by major sectors, including environmental uses, in relation to total renewable freshwater resources, expressed as a percentage [11]. More than 2 billion people live in countries with high water stress, with the global average at 11%. A total of 31 countries presents levels between 25% (alert status) and 70%, while 22 countries exceed 70%, indicating severe water stress.

2.4. Definition and Scope of Water Efficiency

In today's context, where efficient water use is essential for sustainability, it is especially important to measure water consumption and its impact across different sectors. This gives rise to the concept of Water Footprint (WF), a metric that quantifies the volume of freshwater (m^3/year) used to produce goods and services. Introduced in 2002 by Arjen Hoekstra, it aims to reflect the impact of freshwater consumption in different regions. Its application is broad: it can be calculated for processes, products, multinational companies, and even entire countries, regions, river basins, or aquifers, allowing identification of areas under the greatest pressure [28,29].

The WF helps identify water dependency in operations or supply chains, assess water security in the context of climate change and scarcity, and support planning decisions. It has become a key tool for governments, individuals, and businesses to improve sustainable water management and use.

Interest in calculating WF has driven the development of tools such as the Water Footprint Network, which promotes fair and smart freshwater use through collaboration among businesses, organizations, and individuals, and the Water Footprint Calculator, which shows how everyday actions affect water consumption. These platforms help reduce individual WFs and foster more sustainable water management.

2.5. The Water Footprint as an Indicator of Water Sustainability

According to the [30], Resolution 64/292 of July, basic access to drinking water and sanitation is a fundamental human right. Water-related needs include a minimum safe supply for drinking, cooking, washing, and food production. However, these needs and equity standards are difficult to quantify. As an economic, common, and public good, it is considered unfair for some users to exceed a reasonable average individual threshold, thereby encouraging equitable use of the resource.

Sustainable development, understood as meeting present needs without compromising future generations, seeks to ensure a balance between economic growth, environmental care, and social well-being. In this regard, water plays a central role: it is essential for reducing diseases, ensuring social well-being, maintaining population productivity, and preserving ecosystems [31]. Additionally, water is at the core of climate change adaptation, serving as a nexus between the climate system, society, and the environment. [32] notes that the interrelationships between water and sustainability go beyond the social, economic, and environmental dimensions, representing crucial challenges in sustaining the services that drive sustainable development.

The study of WF serves multiple public and private purposes. This indicator allows for the evaluation of water sustainability by considering both direct and indirect use across supply chains. It can be expressed in cubic meters per ton of production, per hectare cultivated, per monetary unit, or other functional units. It helps understand how and why freshwater is consumed or polluted, with the greatest impact in water-scarce areas. According to [33], total WF assessment involves four phases:

1. Definition of goals and scope,
2. WF accounting,
3. Sustainability assessment (environmental, social, and economic),

4. Formulation of responses (strategies, policies, or improvement measures).

WF is divided into three components—green, blue, and grey—based on the origin of water (rain, soil moisture, surface or groundwater, and the volume required to manage pollution). This allows for a comprehensive view of water use (see Table 2).

Table 2: Water Footprint (WF) typology.

Green WF: Rainwater stored in the soil and used by vegetation or crops.	
	It is an indicator of human use of water from precipitation, which is not transformed into streams or groundwater, but is stored in the soil or vegetation. This volume of water is used in production without generating wastewater. Green water is especially useful in crops, agricultural plantations, and forests, although not all of it is usable, as a significant portion evaporates. The green WF of the process is calculated as the sum of green water evaporation plus green water incorporation.
Blue WF: Water extracted from surface or underground sources, used in activities such as agricultural irrigation, domestic consumption or industrial production.	
	It is an indicator of the use of fresh surface or groundwater (renewable or fossil) used in the production of goods or services. Blue water from rivers or aquifers is used directly for irrigation, domestic, or industrial purposes, and can evaporate, return to a different catchment area or the sea, or return during a different period than the collection period. To calculate blue water WF, the evaporation of blue water plus the incorporation of blue water and the lost return flow are considered.
Grey WF: Fresh water needed (volume) to dilute contaminants and maintain water quality standards in an ecosystem	
	This indicator is defined as the volume of freshwater needed to assimilate the pollutant load generated in a process (so that these diluted pollutants become harmless). It is based on the concentrations of that pollutant under natural conditions and on the requirements and demands of existing environmental quality standards or legislation. To calculate the grey WF, the pollutant load or concentration is divided by the difference between the concentration required by legislation and the natural concentration present in the receiving water body.

Source: own elaboration based on [33].

WF can be applied at different levels. In the case of a product, it assesses water consumption and pollution generated at all stages of the production chain. It estimates the total volume of freshwater consumed and polluted to produce goods and services used by an individual consumer. It can be analysed in a defined geographic area—a river basin, province, state, nation, or any other administrative or hydrological unit—considering water use and pollution within that space. Finally, in the case of a company, it is calculated based on two main components: the operational or direct component (water consumed or polluted in its activities) and the supply chain or indirect component (freshwater consumed or polluted in the production of all goods and services). Table 3 shows the relationship between the different types of WF considered.

Table 3: Relationship between the different types of WF.

WF of a Product	= Sum of the WF of the production and supply chain necessary to produce the product
WF of a Consumer	= Sum of the WF of all products consumed
WF of a Company	= Sum of the WF of all final products produced by the company
WF of a Delimited Geographical Area	= Sum of the WF of all processes taking place in that area

Source: own elaboration based on [33].

The quantification of the WF represents a step forward toward achieving the SDGs related to water, within a framework of efficient management and consumption. In productive terms, it is a key indicator in strategic sectors such as agriculture and industry, which should incorporate an economic, social, and environmental dimension into their processes. Agriculture accounts for more than 70% of global water withdrawals, while industry and energy account for 20%, and domestic use represents 10%. Given that more than half of the population lives in urban areas, the sustainable development of water resources is closely linked to urban growth, social equity, and environmental sustainability.

The complexity of measuring the WF is crucial to addressing sustainable socioeconomic development. From an economic sustainability perspective, it is necessary to allocate and use/consume water efficiently. Economically speaking, water use is only sustainable

if the benefits outweigh the total costs associated with the WF. To achieve this, it is essential to invest in technologies that improve the collection, utilization, and productivity of water resources, avoiding waste.

5. Indicator of Efficiency in Sustainable Water Consumption in the Spanish Autonomous Communities

3.1. Methodological Approach

Following the previous discussion, the development of an efficiency indicator for sustainable water use in Spain's Autonomous Communities (CC.AA.) is proposed, with the aim of providing a quantitative assessment of the situation based on regional and national statistical data. This analysis will allow for the normalization of indicators and a more precise evaluation of efficiency and sustainability in water management in Spain.

The 2030 Agenda includes 17 goals and 169 targets, accompanied by 231 indicators designed to be measured using statistical data generated by each country. In the Spanish case, the National Statistics Institute (INE) compiles the statistics “2030 Agenda Indicators for Sustainable Development,” publishing indicators related to the SDGs. The indicators are continuously updated and form part of the current annual statistical program, incorporating information from both the INE and other official sources. Regarding SDG 6, monitoring indicators are defined by the Ministry for the Ecological Transition and the Demographic Challenge. In some cases, national-level data is already available, while in others, possible data sources are still being explored (Table 4).

Table 4: Main Monitoring Indicators (INE) of the 2030 Agenda for Sustainable Development in relation to SDG 6.

Indicator 6.1.1 Proportion of the population using safely managed drinking water services. Percentage.
Indicator 6.2.1 Proportion of the population using: a) safely managed sanitation services, and b) hand-washing facilities with soap and water. Percentage.
Indicator 6.3.1 Proportion of domestic and industrial wastewater flows that are safely treated.
Indicator 6.3.2 Proportion of bodies of water with good ambient water quality. Percentage.
Indicator 6.4.1 Change in water-use efficiency over time.
Indicator 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources. Percentage.
Indicator 6.5.1 Degree of integrated water resources management implementation.
Indicator 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation.
Indicator 6.6.1 Change in the extent of water-related ecosystems over time.
Indicator 6.A.1.1 Amount of official development assistance for water and sanitation that is part of a government-coordinated spending plan. Euros.
Indicator 6.B.1 Proportion of local administrative units with established policies and operational procedures for local community participation in water and sanitation management. Percentage.

Source: Own elaboration based on [34].

Following this logic, the development of an efficiency indicator for the sustainable use of water in the Spanish Autonomous Communities (CC.AA.) is addressed, with the objective of providing a quantitative assessment of the current situation. The information and future updates of the indicators in Table 4 could improve the proposed composite indicator in the following section, provided that regional data is available.

The analysis begins by considering the proportion of water consumed and polluted by human activities, particularly in the agricultural, industrial, and domestic sectors, as reported by the World Water Assessment Programme [7]. Water use is directly related to the productive structures of economies and the amount of water used and degraded by each sector [29].

According to [35], water demand (QA) is defined as the total volume of actual consumption required for human activity, based on five factors:

$QA = D (PA, PB, Y, G, N)$, where

PA: price of water,

PB: price of other substitute or complementary goods,

Y: income of the resident population,

G: water consumption preferences,

N: resident population.

In a broader reflection, additional factors can be considered to analyse water consumption and demand (Table 5).

Table 5: Main factors affecting water demand.

Factors	Components of the factors
Climate	Temperatures Precipitation Climate type (Atlantic, mountain, etc.) Climatic seasonality (spring, summer, autumn, winter)
Population	Population density Migration movements Population size Urban and rural population
Economic situation	National and personal income Gross domestic product (GDP) Trade balance Water price
Infrastructure	Water supply and impoundment Purification, cleaning and control Pressure in the network, sewerage Water quality
Productive activities	Primary sector: Agriculture, livestock, and fishing Industrial sector Tertiary sector and domestic use
Miscellaneous (related to quality of life)	Green areas Vehicle washing Filling swimming pools or watering golf courses Firefighting

Source: Own elaboration adapted from [35].

In this context, just as the calculation of the WF is an optimal tool for water management, the development of an indicator measuring the proximity or distance to efficiency goals in sustainable water use can also be so. Following the approach of [33], a composite indicator can provide information for decision-making regarding the environmental impacts linked to water consumption, such as strategic planning, priority setting, product and process design, and resource investments.

[36] define a composite indicator as “a simplified representation that seeks to summarize a multidimensional concept into a simple (one-dimensional) index based on an underlying conceptual model.” Thus, it allows the integration of several variables more precisely into a specific characteristic or attribute (Table 6). The construction of the composite indicator requires two basic conditions: 1) A clear definition of the objective or concept to be measured. This is not always an easy task, as the multidimensional nature of the concept complicates its concretization. 2) The existence of basic, clear, reliable, and homogeneous information to carry out the corresponding measurement.

Table 6: Advantages and limitations of a composite indicator.

Advantages	Limitations
Allows reducing the complexity of the information analysed individually or from multiple perspectives.	Perception or confirmation biases when reducing the complexity of a topic into a single value that concentrates and therefore measures everything.
Implementation in phases related to subsystems, sub-indicators, or sub-sections that make up the composite indicator, enabling a more comprehensive view.	Excessive simplification of the analysed problem by summarizing all possible information.
Integrates and summarizes different perspectives on a topic, providing a “contextual overview.”	Confusing and unreliable messages if the indicator is poorly constructed or interpreted.
Facilitates comparability between units of analysis.	Possible redundancy in the selection and inclusion of information that will form part of the composite indicator.
Easy to interpret due to its synthesis capability by reducing the size of the initial list of indicators to consider.	Limited to the information available or measurable.

Source: Own elaboration based on [36].

3.2. Database of the composite indicator

The unit of analysis for the indicator are the 17 Autonomous Communities or regions (NUTS 2 level in the European classification), along with Ceuta and Melilla considered jointly due to statistical availability. Additionally, national-level information is used to normalize all indicators (Spain = 100).

The main limitation is obtaining enough data from the same source with information for all regions. Two groups of indicators are designed to build the composite indicator: 1) related to hydraulic resources and environmental conditions of each region; 2) covering the level of water use/consumption, linked to the productive structure and socioeconomic conditions of the analysed territory.

For the selection of indicators, the integral water cycle is taken as the first reference, which includes the capture and purification of water, the supply (provision and distribution) of drinking water, and the sanitation (sewage and treatment) of wastewater before its return to the natural environment without causing environmental damage.

To facilitate availability, homogenization, and possible replicability of the process, most indicators about available resources are obtained from the Spanish National Institute of Statistics (INE), particularly from the “Statistics on Water Supply and Sanitation.” The information is complemented with the “Water Balance Statistics” from the State Meteorological Agency (AEMET) [37], which includes data on precipitation, evapotranspiration, and soil moisture. For simplicity and utility, annual accumulated precipitation data (litres/m²) and soil moisture expressed as the percentage of water available to plants, considering a total available water reserve equal to the maximum reserve will be used. Similarly, the Climate Surveillance Statistics from AEMET are used, providing key data on climatic conditions such as monthly average temperature, monthly averages of daily maximum and minimum temperatures, and monthly accumulated precipitation. For this analysis, the average temperature of each region is selected.

Regarding available resources, it is fundamental to consider the water available in rivers that cross each Autonomous Community, as well as reservoir water. This information is collected by river basins, which are essential for integrated and sustainable management,

although “water management by basins should not be understood as a ‘panacea’ but as an adaptive co-management practice” [38]. Therefore, the most accurate approach would be to use the information provided by the hydrographic confederations, as shown in Table 7. However, one of the main limitations identified is the lack of homogeneous information about the flow of each river, which should also be distributed by region according to population or area in km². Given this difficulty, it is considered a possible future improvement, and for now, it is omitted from the indicator.

Table 7: Hydrographic Confederations in Spain.

Hydrographic Confederation	Main rivers	Regions (NUTS 2) / provinces (NUTS 3)
Intercommunity		
Geographical demarcation of the Guadalquivir	Genil, Guadaira, Guadalete, Guadalbullón, Guadalquivir	Andalusia, Castile-La Mancha, Murcia, Extremadura
Hydrographic demarcation of the Segura	Segura and its tributaries (Mundo, Taibilla, Guadalentín)	Murcia, Com. Valenciana, Castile-La Mancha, Andalusia
Hydrographic demarcation of the Júcar	Júcar, Cabriel, Turia	Catalonia, Valencian Community, Aragon, Castile-La Mancha, Murcia
Hydrographic demarcation of the Cantabrian Sea	Eo, Portia, Navia, Esva, Narcea, Nalón, Sella, Cares, Nansa, Saja, Besaya, Pas, Miera, Asón and Agüera Nervión, Oria and Urumea and Bidasoa	Asturias, Cantabria, Basque Country, Navarra and Castile and Leon
Intra-community		
Hydrographic Demarcation of Galicia Coast	Verdugo, Ría de Vigo y Ría de Baiona.	A Coruña, Lugo y Pontevedra

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Hydrographic Demarcation of the Internal Basins of the Basque Country		Deba, Urola, Ibaizabal, Butroe y Oka	Álava, Guipúzcoa y Vizcaya
Hydrographic Demarcation of the Internal Basins of Catalonia		Ter y Llobregat.	Barcelona, Tarragona, Gerona y Lérida
Hydrographic demarcation of the Atlantic basins of Andalusia	Guadalete-Barbate Hydrographic District	Guadalete y Barbate	Cádiz
	Tinto-Odiel-Piedras Hydrographic District	Tinto, Odiel, Piedras y Chanza.	Huelva
	Mediterranean Hydrographic District		Cádiz, Granada, Málaga, Almería y Córdoba
Hydrographic Demarcation of the Balearic Islands			Balearic Islands
Hydrographic Demarcation of the Canary Islands			Canary Islands
Shared with other countries			
Miño-Sil River Basin District		Avia, Deva, Limia, Arnoya, Bibei, Miño y Sil.	Galicia, Castile and Leon and Asturias
Duero River Basin District		Duero, Adaja, Águeda, Arlanza, Arlanzón, Bernesga, Carrión, Cega, Eresma, Eria, Esla, Luna, Órbigo, Pisuerga, Támega, Tera y Tormes	Castile and Leon, Galicia, Cantabria, La Rioja, Castile-La Mancha, Extremadura and Madrid.
Tajo River Basin District		Tajo	Aragon, Castile-La Mancha, Castile and Leon, Madrid and Extremadura

Guadiana River Basin District	Alcudia, Jabalón Azuer, Pinilla, Rus y Córcoles.	Castile-La Mancha, Andalusia and Ex- tremadura
Ebro River Basin District	Ebro y Garona	Castile and Leon, Cantabria, Basque Country, Rioja, Navar- ra, Aragon, Castile-La Mancha, Valencian Community and Cat- alonia.
Ceuta River Basin District		Autonomous City of Ceuta
Melilla River Basin District		Autonomous City of Melilla

Source: Own elaboration. Spanish Agricultural Guarantee Fund (FEGA). List of Hydrographic Confederations. Ministry of Agriculture, Food and Environment.

In the case of reservoirs by hydrographic basin, there are more than 350 reservoirs in Spain with a total capacity of 54,000 hm³ of water, equivalent to 50% of the country's river flow (www.embalses.net). The greatest capacity (14,225 hm³) is found in Extremadura, with the La Serena reservoir (Badajoz) located on the Júcar River, followed by Andalusia (11,385 hm³) and Castile and Leon (8,305 hm³), while La Rioja has only 136 hm³ [39]. However, data on stored water cannot be included due to a lack of information for the Balearic Islands, Canary Islands, and Ceuta and Melilla.

Based on the available information for all Autonomous Communities and the relevance of each indicator, Table 8 presents the proposed indicators selected to construct the composite indicator. The table specifies their effect (positive or negative) and their relationship with the aspects developed in the study on water footprint and sustainability. The data correspond to 2018 for water consumption indicators and to 2019 for the rest, totalling 13 indicators used.

Table 8: List of indicators considered for the development of the composite indicator.

Indicator	Effect on the indicator and justification	Relationship with water footprint	Relationship with sustainability typology
Subindicator 1. Water resources and environmental conditions S1			

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Volume of available potable water litres/ inhabitant/day, Source: INE	Positive, water resources	Improving blue WF, increasing the volume of freshwater accessible for consumption	Social Direct, reducing dependence on blue and green water
Percentage of actual losses relative to the volume of water supplied, %, Source: INE	Negative, lost water resources	Worse blue WF, unproductive supply chains	Economic Indirect, technical inefficiency, and waste of water resources
Volume of treated wastewater cubic meters/ day/1,000 inhabitants, Source: INE	Positive, water resources	Improving grey WF, recycling and remediation of contaminated water	Environmental Direct reuse of water resources
Volume of sludge generated in wastewater treatment tons of dry matter/ year/inhabitants, Source: INE	Positive, generated energy resources	Improving grey WF, recycling and remediation of contaminated water	Environmental, circular economy, sustainable development
Precipitation litres/m ² , Source: AEMET	Positive, generated water resources	Improving green WF, increasing freshwater reserves	Environmental, circular economy, sustainable development
Average temperature degrees °C, Source: AEMET	Affects the water balance	Worse green/blue/grey WF, desertification	Environment, ecosystems, human and animal health, agriculture
% Soil moisture above maximum capacity %, Source: AEMET	Negative, evapotranspiration	Improving green WF, ecosystems and use of blue water	Environmental, ecosystem maintenance and increased rainfall
Greenhouse Gas (GHG) CO ₂ Emissions Kt/1,000 inhabitants, Source: Ministry for the Ecological Transition and the Demographic Challenge	Affects the water balance	Worse green WF, atmospheric carbonization and side effects on other variables (temperature)	Environmental, rising temperatures, deteriorating water and air quality
Subindicator 2. Uses/factors and conditions of water consumption S2			

Household water consumption, litre/inhabitant/day, Source: INE	Negative: outdated facilities, inefficient use	Worsening of blue WF, inefficient consumption	Social: waste of water resources due to inefficiency
Population with higher education, %, Source: INE	Positive: increased awareness of efficient use	Improving green/blue/grey WF, contributing to circular economies	Social: understanding and awareness of the importance of a sustainable society
Population density, inhabitants/km ²	Negative: concentration of demand	Worsening of blue WF, overexploitation of water resources	Social: waste generation
Agricultural and industrial activity, %GVA, agriculture and manufacturing industry, as a percentage of total GVA, Source: INE	Negative: intensive operations, wastewater pollution	Worsening of blue/grey WF, crop and pasture needs, CO ₂ emissions, and increased consumption in operational activities	Economic: deterioration of ecosystems
Energy production, GWh per inhabitant, Source: Electric grid	Positive: hydroelectric plants	Improving green/blue/grey WF, energy transition	Economic: renewable energy sources

Source: own elaboration based on [40]. INE Water Indicators, Water Supply and Sanitation Statistics, Regional Accounts, Labor Force Survey, AEMET, Water Balance Statistics and Climate Monitoring Statistics.

6. Results

To construct the index, differentiated weightings are applied to the indicator groups, following the proposal by [40]. Since water resource availability and environmental factors have a more intense and direct impact, Subindicator 1 receives a weight of 60%, distributed equally among its 8 indicators. Subindicator 2, related to use and conditioning factors, is weighted at 40%, assigning equal weight to its 5 variables. This uniform distribution is due to the lack of sufficient historical information to establish differentiated weightings objectively.

Thus, the Composite Indicator of Efficiency in the Sustainability of Water Use in Spanish Regions (IESWUR) is proposed as a weighted sum of the two subindicators:

$IESWUR = 0.60 * S1 + 0.40 * S2$, where:

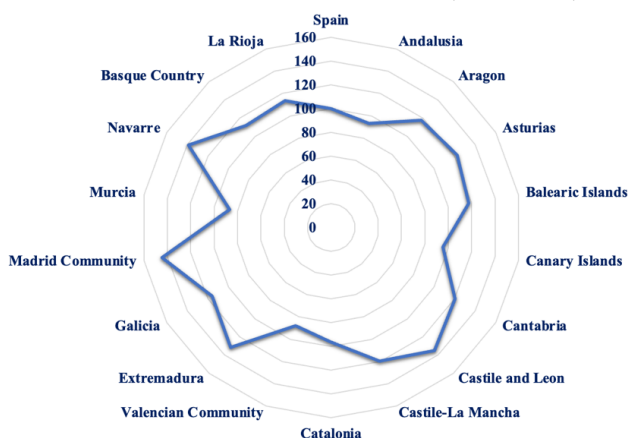
$S1 = \sum I_i \text{ from } i = 1 \dots 8 \text{ (Table 6)} / n1$, with $n1 = 8$

$S2 = \sum I_i \text{ from } i = 9 \dots 13 \text{ (Table 6)} / n2$, with $n2 = 5$

These are calculated based on data referenced to the value obtained for Spain, set to 100, so that all Autonomous Communities are comparable. Each indicator I_i (with $i = 1 \dots 13$) is previously adjusted either according to the number of inhabitants or expressed as a share of a regional total or as a percentage, as specified in Table 6.

The results show a relatively better positioning for the Community of Madrid, Navarre, Castile and Leon, Extremadura, and Asturias, which, along with seven other regions, exceed the national average (Spain = 100). In contrast, five regions—along the Mediterranean arc, the south, and the Canary Islands—show values below the national reference. Figure 1 offers a clearer visualization of these divergences, which are mainly based on differences in demographic and economic variables, especially in the productive structure.

Figure 1: Indicator of Efficiency in the Sustainability of Water Use in the Spanish Autonomous Communities (IESWUR).



Source: Own elaboration.

7. Conclusions and Recommendations

This work presents a proposed quantitative analysis tool based on an indicator of sustainability and efficiency in water use, which reflects how analytical approaches change when certain variables are incorporated. The composite indicator, made up of thirteen variables, offers a simplified summary of the behaviour of environmental conditions, consumption, and the use of water resources. The variables are grouped into two dimensions: water resources and environmental conditions; and water consumption uses/factors and constraints. The resulting composite indicator, IESWUR, highlights how climatic, demographic, social, political, and economic differences among the Spanish Autonomous Communities affect the efficiency of sustainable water use.

Regional differences shown by the composite indicator can be explained by uneven population growth, migratory movements, changes in consumption patterns, climatic and environmental conditions, improvements in water supply, and the impact of tourism in certain regions. In terms of consumption, there has been an intensive increase in goods and services linked to improved household income during Spain's periods of economic growth, which has progressively increased the water footprint. Regarding population growth, the explanatory factor is the arrival of both national and foreign immigrants, which raises demand for water resources.

In the study by [35] on the total supply of water footprint in Spain and its regions, useful insights are offered to interpret the results of the proposed composite indicator. At the national level, an upward trend in water supply is observed, driven by increasing demand from the population and productive sectors. At the regional level, this demand follows different patterns depending on the climatic, demographic, social, political (management), and economic conditions of each region.

In this regard, measuring efficiency requires improving primary data collection and strengthening water governance. Prolonged droughts, desertification, and population growth demand more efficient and resilient management models, as highlighted by [41]. This entails not only modernizing infrastructure and water-saving

technologies but also strengthening international cooperation and developing composite indicators that allow for assessing performance in water resource management.

Water scarcity can be physical—a lack of available water—or economic—a lack of infrastructure and financial resources to guarantee its access and distribution—. Both limit sustainable development and can cause conflicts between sectors and territories. Therefore, integrated water management is essential to improve efficiency, requiring greater coordination between sectors and governments to prioritize investments in water. Ensuring its future availability demands a comprehensive approach that combines technological innovation, effective public policies, and a global commitment to its conservation.

In this context of increasing global water scarcity, it is crucial to move toward a circular economy approach linked to water reuse. As noted by [42], it is essential to promote social acceptance of reclaimed water use, as even technically and economically viable water reuse projects can fail due to social rejection. This perception depends on trust in the technology, the regulatory framework, project management, and the quality of the reclaimed water.

8. Bibliography

- [1] Arrojo P. El reto ético del agua. *Relac Int.* 2009;(12):33–53.
- [2] Peña RM, Vargas GV, Aguayo GAG, de Cádiz Hernández ATG. El acceso al agua como derecho humano inalienable de los seres humanos. *Soc Tecnol.* 2022;5(Supl 1):200–9.
- [3] UNESCO. *Informe Mundial sobre el Desarrollo de los Recursos Hídricos 2023: alianzas y cooperación por el agua; datos, cifras y ejemplos de acción.* París: UNESCO, World Water Assessment Programme; 2023.
- [4] UNESCO. *Informe Mundial sobre el Desarrollo de los Recursos Hídricos 2021: El valor del agua.* París: UNESCO; 2021. Disponible en: <https://bibliotecadigital.ciren.cl/server/api/core/bitstreams/97a9a861-f2b6-4651-9669-46e63dbde603/content>
- [5] Fernández-Cirelli A. El agua: un recurso esencial. *Quím Viva.* 2012;11(3):147–70.
- [6] Fontán F. Prólogo. *INNOTECH.* 2015;(10): ene–dic. Revista del LATU, Laboratorio Tecnológico del Uruguay.
- [7] World Water Assessment Programme (WWAP). *The United Nations World Water Development Report 3: Water in a Changing World.* París: UNESCO; Londres: Earthscan; 2009.
- [8] ONU-Agua. *Un objetivo global para el agua post-2015: síntesis de las principales conclusiones y recomendaciones de la ONU-Agua.* Vigésima reunión de ONU-Agua;

- 27 january 2014. https://www.gwp.org/globalassets/global/gwp-cam_files/un-objetivo-global-para-el-agua-post-2015.pdf
- [9] Restrepo I. Tendencias mundiales en la gestión de recursos hídricos: desafíos para la ingeniería del agua. *Ing Compet.* 2004;6(1):63–71. doi:10.25100/iyv.v6i1.2289
 - [10] Aldaya M, Niemeyer I, Zarate E. Agua y globalización: retos y oportunidades para una mejor gestión de los recursos hídricos. *Rev Esp Estud Agrosoc Pesq.* 2011;(230):61–83. <https://ageconsearch.umn.edu/record/186934/?v=pdf>
 - [11] UNESCO. *Informe de las Naciones Unidas sobre el desarrollo de los recursos hídricos 2019: No dejar a nadie atrás*. París: ONU-Agua; 2019. <https://unesdoc.unesco.org/ark:/48223/pf0000367304>
 - [12] Delgado WG. Gestión y valor económico del recurso hídrico. *Rev Finanzas Polit Econ.* 2015;7(2):279–98.
 - [13] Albiac J, Esteban E, Baccour S. La situación y perspectivas de los recursos hídricos en España. Madrid: Fedea; 2023. (Estudios sobre la Economía Española, no. 2023-29). <https://documentos.fedea.net/pubs/eee/2023/eee2023-29.pdf>
 - [14] Pulido-Velázquez M, Cabrera Marcet E, Garrido Colmenero A. Economía del agua y gestión de recursos hídricos. *Ing Agua.* 2014;18(1):99–110.
 - [15] Food and Agriculture Organization (FAO). *El estado de los recursos de tierras y aguas del mundo para la alimentación y la agricultura. Sistemas al límite. Informe de síntesis 2021*. Roma: Organización de las Naciones Unidas para la Alimentación y la Agricultura; 2021. <https://openknowledge.fao.org/handle/20.500.14283/cb7654es>
 - [16] de la Torre FB. Los recursos hídricos en el mundo: cuantificación y distribución. *Cuad Estrategia.* 2017;(186):21–70.
 - [17] Panel Intergubernamental de Expertos sobre el Cambio Climático (IPCC). *Cambio climático 2021: bases físicas. Resumen para responsables de políticas*. Suiza: IPCC; 2021.
 - [18] Jódar-Abellán A, Ruiz Álvarez V, Prats D. Reflexiones sobre la repercusión del cambio climático en los elementos del balance hídrico a escala global. Alicante: Universidad de Alicante; 2019. https://rua.ua.es/dspace/bitstream/10045/88478/1/Congreso_Nacional_Agua_2019_1361-1374.pdf
 - [19] Abbaspour KC, Rouholahnejad E, Vaghefi S, Srinivasan R, Yang H, Kløve B. A continental-scale hydrology and water quality model for Europe: Calibration and uncertainty of a high-resolution large-scale SWAT model. *J Hydrol.* 2015; 524:733–52. doi: 10.1016/j.jhydrol.2015.03.027
 - [20] Wada Y, van Beek LP, Bierkens MF. Non sustainable groundwater sustaining irrigation: A global assessment. *Water Resour Res.* 2012;48(6). doi:10.1029/2011WR010562
 - [21] Qing Y, Wang S, Yang Z, Gentile P. Soil moisture–atmosphere feedback have triggered the shifts from drought to pluvial conditions since 1980. *Commun Earth Environ.* 2023;4(1):1–10. doi:10.1038/s43247-023-00922-2
 - [22] Zaveri ED, Damania R, Engle NL. *Droughts and Deficits – Summary Evidence of the Global Impact on Economic Growth*. Washington, D.C.: World Bank Group, Water Global Practice; 2023. <http://documents.worldbank.org/curated/en/099640306142317412>

- [23] Network for Greening the Financial System. *NGFS long-term scenarios for central banks and supervisors*. 2024. <https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-climate-scenarios-central-banks-and-supervisors-phase-v>
- [24] Hall EL, Dietrich AM. A brief history of drinking water. *Opflow*. 2000;26(6):46–9. doi:10.1002/j.1551-8701.2000.tb02243.x
- [25] Villalba A, Rivero MM, Guijarro A. Los derechos humanos al agua potable y al saneamiento en la Agenda 2030. Bilbao: UNESCO Etxea – Centro UNESCO del País Vasco; ONGAWA, Ingeniería para el desarrollo humano; 2016. <https://ongawa.org/informe-derechos-humanos-al-agua-y-al-saneamiento-en-la-agenda-2030/>
- [26] Escalante LC, Charpentier C. Barreras que afectan la gestión integrada de los recursos hídricos: el caso de Panamá. *Rev Posgrado Soc*. 2016;14(1):14–24.
- [27] Confederación Española de Organizaciones Empresariales (CEOE). *Informe sobre el agua en España: situación actual, retos y oportunidades*. Madrid: CEOE; 2023. <https://www.ceoe.es/es/publicaciones/sostenibilidad/informe-sobre-el-agua-en-espana-situacion-actual-retos-y-oportunidades>
- [28] Seyam IM, Hoekstra AY, Savenije HHG. Calculation methods to assess the value of upstream water flows and storage as a function of downstream benefits. *Phys Chem Earth A/B/C*. 2002;27(11–22):977–82.
- [29] Hoekstra AY. Water footprint assessment: evolvement of a new research field. *Water Resour Manag*. 2017;31(10):3061–81. doi:10.1007/s11269-017-1618-5
- [30] UN. The human right to water and sanitation. UN General Assembly, 64th session, agenda item 48, 2010, UN, Nueva York, https://www.un.org/waterforlifedecade/human_right_to_water.shtml
- [31] Organización de las Naciones Unidas (ONU). *Decenio Internacional para la acción ‘El agua fuente de vida’ 2005–2015*. Nueva York: Asamblea General de la ONU; 2004.
- [32] UNESCO. “Informe de las Naciones Unidas sobre los Recursos Hídricos en el Mundo 2015”. 06134 Colombella. Perugia, Italia: Oficina del Programa sobre Evaluación Mundial de los Recursos Hídricos, División de Ciencias del Agua. 2015. <http://www.unesco.org/>
- [33] Hoekstra, A.Y.; Chapagain, A.K.; Aldaya, M.M.; Mekonnen, M.M. The Water Footprint Assessment Manual: Setting the Global Standard; Earthscan: London, UK, 2011. http://waterfootprint.org/media/downloads/TheWaterFootprintAssessmentManual_2.pdf
- [34] Instituto Nacional de Estadística (INE). *Indicadores de la Agenda 2030 para el Desarrollo Sostenible* [Internet]. INE. <https://www.ine.es/dyngs/ODS/es/index.htm>
- [35] Sotelo M. Aspectos económicos, sociales y territoriales de la huella hídrica española [tesis doctoral]. Madrid: Universidad Complutense de Madrid; 2018. Disponible en: <https://eprints.ucm.es/id/eprint/47991/>
- [36] Schushny, A.; Soto, H. Diseño de indicadores compuestos de desarrollo sostenible, Comisión económica para América Latina y el Caribe (CEPAL), 2009, Naciones Unidas, Santiago de Chile.
- [37] Agencia Estatal de Meteorología (AEMET). *Estadística del balance hídrico*. Gobierno de España.

- [38] Del Moral, L.; Hernández-Mora, N. Nuevos debates sobre escalas en política de aguas. Estado, cuencas hidrográficas y comunidades autónomas en España. Ciudad y Territorio. Estudios territoriales. 2016, Vol. 48 (190) pp. 563-583.
- [39] Fundación Aquae. *Los embalses de España de norte a sur* [Internet]. 2022. Disponible en: <https://www.fundacionaquae.org/embalses-de-espana/>
- [40] Crespo S. La importancia de la valoración económica de la huella hídrica, eficiencia y sostenibilidad en el consumo de agua en el contexto de los objetivos de desarrollo sostenible [Trabajo de Fin de Grado]. Madrid: Universidad Autónoma de Madrid; 2021. Dirigido por: López AM.
- [41] Ministerio para la Transición Ecológica y el Reto Demográfico (MITECO). *Libro Verde de la Gobernanza del Agua en España*. Madrid: MITECO; 2020. https://www.miteco.gob.es/content/dam/miteco/es/agua/temas/sistema-espaniol-gestion-agua/libro-verde-gobernanza/libro-verde-gobernanza-agua_tcm30-517206.pdf
- [42] López E, Tirado S, Briones A. Economía circular y agua: oportunidades para una economía competitiva y resiliente en el nuevo ciclo europeo. *ARI*. 2025;(21). Madrid: Real Instituto Elcano; 28 de febrero. <https://www.realinstitutoelcano.org/analisis/economia-circular-y-agua-oportunidades-para-una-economia-competitiva-y-resiliente-en-el-nuevo-ciclo-europeo/>

Impact of Business Confidence on the Employment Rate in the Araucanía Region of Chile: A Lagged Confidence Analysis

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Abstract

Business confidence is a crucial indicator that reflects entrepreneurs' perceptions of the past, present, and future economic situation, influencing investment and employment decisions. This study analyzes how lagged confidence perceptions regarding future sales, prices of goods and services, and other aspects impact the future employment rate in the Araucanía region. The literature highlights the relationship between business confidence and macroeconomic variables, emphasizing its role in investment and employment. Previous studies show that high business confidence can stimulate economic growth and hiring, acting as a leading indicator of future economic performance. ARDL, OLS, IV, and GMM models were used to assess the relationship between lagged perceptions and the employment rate, based on business confidence survey data. Positive lagged perceptions of future sales, prices of goods and services, and investment are associated with a higher future employment rate, while high past expectations of national demand show a negative

relationship. The discussion focuses on how business confidence about future sales, investment, price expectations, and the intention to hire more workers drives greater hiring, whereas overestimation of national demand can lead to less cautious employment decisions. Past business perceptions significantly influence future employment rates, underlining the importance of monitoring and understanding these perceptions to improve employment strategies and economic policies in Araucanía.

Keywords: Business confidence, employment rate, lagged perceptions, econometric models, business expectations.

1. Introduction

Business confidence is a determining factor in economic and employment decision-making. Entrepreneurs' perceptions regarding sales, prices, and future demand significantly influence the employment rate, reflecting both current economic conditions and future business outlooks. Previous studies have shown that a high level of business confidence can drive economic growth, encourage investment, and increase employment. In the Araucanía region, these perceptions are essential for planning growth strategies and adapting to market conditions, due to the region's economic dynamics and specific challenges in business development and employment. This study focuses on analyzing how lagged perceptions of various economic aspects affect the future employment rate, using monthly business confidence survey data collected by the Universidad Autónoma de Chile in Temuco, combined with employment rate records from the National Institute of Statistics (INE) in Araucanía. Several econometric models were applied, including ARDL, OLS, IV, and GMM, with the more robust models addressing issues of endogeneity, heteroskedasticity, and autocorrelation. The results provide a detailed view of how past business perceptions influence the future employment rate, highlighting the importance of monitoring and understanding these perceptions to improve employment strategies and economic policies in the Araucanía region.

2. Theoretical Framework

The theoretical framework of this study is grounded in a broad body of literature that has explored the relationship between business confidence and various macroeconomic variables, including investment, employment, and economic growth. Several studies have highlighted the crucial role of business confidence as a leading indicator of future economic performance. This review includes research that addresses different aspects of business confidence and its impact on the economy.

Adekoya and Oliyide (2021) pointed out that business confidence can be a strong predictor of future growth. Their study, focused on OECD countries, found that economic policy uncertainty and oil price shocks have a significant impact on business confidence, which in turn influences economic growth. This finding is consistent with the idea that business confidence reflects expectations about the future economic environment particularly future prices which affects investment and hiring decisions.

In a study on uncertainty and employment dynamics, Ghosal and Ye (2015) found that higher uncertainty negatively impacts employment growth, particularly affecting small businesses. Using regression models and survey data, the study showed that economic uncertainty can hinder hiring decisions in small enterprises, which tend to be more vulnerable to financial constraints and asymmetric information.

Khan and Upadhayaya (2019) demonstrated that business confidence has significant predictive power for business investment growth in the U.S. These authors suggested that shocks to business confidence—also known as “animal spirits”—reflect short-lived non-fundamental factors that can influence business decision-making. Their research showed that an increase in business confidence is associated with higher levels of investment, which in turn can lead to sustained economic growth.

Dasgupta and Lahiri (1993) showed that business confidence has explanatory power in predicting turning points in the business cycle. Using advanced econometric models, the authors found that

entrepreneurs' expectations about the future economy are valuable indicators for forecasting shifts in the economic cycle. Similarly, Heye (1993) examined the relationship between business confidence and labor market conditions in the U.S. and other industrialized countries, highlighting the importance of business expectations in shaping hiring and expansion strategies.

Taylor and McNabb (2007) and Lahiri et al. (2016) found that both business and consumer confidence contain independent and additional information for forecasting macroeconomic variables, including consumption and investment behavior. These studies demonstrated that both business and consumer confidence are important for understanding overall economic performance, particularly in terms of aggregate demand. This study found that high perceptions of national demand do not always translate into immediate employment increases, which may be due to excessive optimism leading to overestimation of future demand.

Moreover, Leeper (1992) and Matsusaka and Sbordone (1995) discussed the impact of consumer confidence on industrial production and unemployment, suggesting that sentiment can play a significant role in predicting economic performance. Lucas and Rapping (1969) as well as Phelps (1967) established that inflation expectations significantly influence employment and wage decisions. These studies show that business expectations about future prices affect the labor market, suggesting that greater confidence in future prices may lead to higher employment levels, as businesses anticipate increased revenues and expand their workforce in preparation.

Green (2022) analyzed price expectations for services and their impact on the labor market. Using regression models and cointegration analysis, Green found that firms expecting higher future prices are more likely to increase their workforce, anticipating higher future revenues that would justify staff expansion. Hille and Schupp (2019) explored the impact of expectations about the prices of services and goods on labor market dynamics, using regression models and cointegration analysis. Their research focused on how service price expectations influence companies' hiring decisions, finding similar results. This study is based on a wide range of research that has demonstrated the relevance of business confidence as a key indicator

of future economic performance, and how this confidence influences critical decisions such as investment and particularly employment. This theoretical framework provided a solid foundation for analyzing business perceptions in the Araucanía region and their impact on future employment rates.

3. Materials and Methods

The data used in this study comes from lagged responses to business confidence surveys conducted in the Araucanía region by the Universidad Autónoma de Chile in the city of Temuco. These include perceptions regarding future sales, future prices, current national demand, and future investment. The surveys are conducted monthly, covering the period from September 2017 to March 2024. For the analysis, the employment rate reported by the Instituto Nacional de Estadísticas (INE) of Araucanía, recorded in rolling quarters over the same period, was used.

Initially, Autoregressive Distributed Lag Models (ARDL) were considered due to their ability to determine optimal lags and handle time series with different levels of integration. According to Pesaran and Shin (1999), ARDL models are effective for analyzing dynamic relationships between variables with different orders of integration. However, the initial results (Table 1) showed that most of the parameters were not significant despite having a high R^2 . This indicated potential endogeneity issues, leading to the exploration of more robust methods.

Table 1: ARDL Model Results.

Dep. Variable:	tasaocup	No. Observations:	81
Model:	ARDL(2, 2, 3, 3)	Log Likelihood	-101.466
Method:	Conditional MLE	S.D. of innovations	0.874
Date:	Fri, 21 Jun 2024	AIC	230.931
Time:	05:49:46	BIC	264.103
Sample:	3	HQIC	244.221
	81		

	coef	std err	z	P> z	[0.025	0.975]
tasaocup.L1	1.5495	0.092	16.822	0.000	1.366	1.733
tasaocup.L2	-0.5575	0.092	-6.028	0.000	-0.742	-0.373
pvtas3m.L0	-0.0024	0.004	-0.664	0.509	-0.010	0.005
pvtas3m.L1	-8.607e-05	0.004	-0.023	0.981	-0.007	0.007
pvtas3m.L2	0.0103	0.003	2.952	0.004	0.003	0.017
dnac.L0	0.0047	0.007	0.630	0.531	-0.010	0.020
dnac.L1	-0.0019	0.008	-0.248	0.805	-0.018	0.014
dnac.L2	-0.0035	0.008	-0.466	0.643	-0.019	0.012
dnac.L3	-0.0134	0.008	-1.769	0.081	-0.028	0.002
trab3m.L0	0.0096	0.008	1.215	0.229	-0.006	0.025
trab3m.L1	0.0234	0.009	2.571	0.012	0.005	0.042
trab3m.L2	0.0013	0.010	0.127	0.899	-0.019	0.021
trab3m.L3	-0.0226	0.008	-2.727	0.008	-0.039	-0.006

Source: Own elaboration based on survey data.

The next step was to apply Ordinary Least Squares (OLS) and Instrumental Variables (IV) models corrected for heteroskedasticity and autocorrelation. The OLS model was used as an initial approach to estimate the regression coefficients by minimizing the sum of squared errors. The OLS methodology served as a starting point to obtain a preliminary estimation of the relationships among variables, following Wooldridge's (2010) recommendations on correcting heteroskedasticity using robust standard errors.

To address potential endogeneity issues, the IV model was applied using the Two-Stage Least Squares (2SLS) method, employing instrumental variables such as the level of confidence regarding past sales performance and past business conditions. According to Angrist and Pischke (2009), this method is suitable for correcting endogeneity bias by using instruments that are correlated with the endogenous variables but not with the model's error term. These instrumental variables are considered exogenous and help correct potential biases in estimates caused by the presence of endogeneity when incorporating lagged employment rate as an explanatory variable.

The IV-GMM approach was selected due to its capacity to address endogeneity problems and provide more consistent estimations (Hansen, 1982). Lagged variables were generated for relevant business perceptions (future sales, future investment, service prices, national demand, and future employment) using different lags as deemed necessary. Then, all time series were aligned by eliminating initial missing values to ensure data consistency.

To check for and eliminate potential multicollinearity issues, the Variance Inflation Factor (VIF) was used, removing variables with VIF values higher than 7. Subsequently, the IV-GMM model was applied, using additional instruments to strengthen model identification and correct for heteroskedasticity and autocorrelation in the residuals. Instrument validity was assessed using the Hansen J test.

The IV-GMM model adjustment process included incorporating autocorrelation terms to address possible issues in the model's residuals. This was done by fitting an autoregressive (AR) model to the residuals of the original model and then including the autocorrelation terms in the IV-GMM model. This procedure allowed for correction of residual autocorrelation, providing more accurate and reliable estimates. Based on this, the adjusted model was defined as follows:

Equation 1: Proposed IV-GMM Model.

$$\begin{aligned} \text{tasaocup}(t) = & \alpha + \beta_1 \text{evtas3m}(t-1) + \beta_2 \text{inver3m}(t-2) + \beta_3 \text{pvtas3m}(t-1) \\ & + \beta_4 \text{pvtas3m}(t-2) + \beta_5 \text{dnac}(t-2) + \beta_6 \text{trab3m}(t-2) + \beta_7 \text{tasaocup}(t-1) \\ & + \beta_8 \text{residuals}(t-1) + \varepsilon(t) \end{aligned}$$

The equation above expresses the relationship between the employment rate at time t and lagged business perceptions regarding future sales (evtas3m), future sales prices (pvtas3m), national demand (dnac), projected future employment (trab3m), the lagged employment rate (tasaocup), and lagged residuals derived from autocorrelation correction.

4. Results

The results (Table 2) show that positive perceptions about future sales and service prices are consistently associated with a higher future

employment rate across all three models. In contrast, high perceptions of national demand have a negative relationship with the employment rate, suggesting a potential overconfidence that does not immediately translate into increased employment. The positive coefficients for lagged future sales perceptions suggest that when firms anticipate increased sales, they tend to hire more employees. This is consistent with the theory that optimistic expectations regarding sales growth encourage workforce expansion.

The positive coefficients for perceptions about future service prices indicate that companies expecting higher future prices are more willing to expand their workforce. This may be due to the expectation of higher future revenues that justify additional hiring.

Table 2: Results of the OLS, IV, and GMM Models.

Variable	OLS	IV	GMM
const	6.2845**	21.8650***	20.3784***
dnac_lag2	-0.0157	-0.0220*	-0.0222**
evtas3m_lag1	0.0088	0.0182**	0.0170**
inver3m_lag1	0.0055	0.0157*	0.0151**
pvtas3m_lag1	0.0008	0.0010	0.0020
pvtas3m_lag2	0.0101	0.0181***	0.0172***
residuals_lag1	-	0.7907***	0.7624***
tasaocup_lag1	0.8693***	0.5574***	0.5847***
trab3m_lag2	0.0234*	0.0331***	0.0272***
R ²	0.9476	0.9301	0.9365
AIC	260.5670	277.8820	270.5044
BIC	279.5226	298.9762	291.5987

Note: *p<0.1; **p<0.05; ***p<0.01

Source: Own elaboration based on survey data.

The results obtained from the OLS, IV, and GMM models show significant differences in the coefficients of the independent variables, highlighting the importance of selecting the appropriate model for this

type of analysis. In the OLS model, the constant coefficient is 6.2845**, indicating that in the absence of other variables, the employment rate is relatively low. However, when IV and GMM models are used, this coefficient increases significantly to 21.8650*** and 20.3784***, respectively, suggesting that these models better capture the variability explained by business perceptions. For the lagged variable of national demand (dnac_lag2), the coefficients are negative across all three models: -0.0157 in OLS, -0.0220* in IV, and -0.0222** in GMM. This suggests that high perception of lagged national demand is associated with a lower future employment rate, possibly due to overconfidence that does not translate into immediate hiring.

Lagged perceptions about future sales (evtas3m_lag1) show positive coefficients in all models, with 0.0088 in OLS, 0.0182** in IV, and 0.0170** in GMM. This indicates that optimistic expectations about future sales encourage employee hiring. For the lagged investment variable (inver3m_lag1), the coefficients are also positive: 0.0055 in OLS, 0.0157* in IV, and 0.0151** in GMM. This suggests that positive perceptions of future investment are associated with an increase in the employment rate, reflecting companies' preparation for expansion.

The coefficients of the lagged variable on future service prices (pvtas3m_lag1) are low and not significant in all three models, which may indicate that short-term price expectations do not have a direct impact on the employment rate. However, the coefficient of pvtas3m_lag2 is positive and significant in the IV and GMM models (0.0181*** and 0.0172***, respectively), suggesting that expectations of higher prices have a positive effect on the employment rate over longer periods. The model residuals (residuals_lag1) show a positive and significant coefficient in the IV and GMM models (0.7907*** and 0.7624***), indicating an important autocorrelated component that these models capture.

Regarding the lagged employment rate variable (tasaocup_lag1), it shows highly significant and positive coefficients in all models: 0.8693*** in OLS, 0.5574*** in IV, and 0.5847*** in GMM, indicating high persistence of the employment rate over time. Due to the greater number of significant parameters compared to the other models, the robustness and efficiency of the IV-GMM econometric model were assessed through additional testing using bootstrap sampling and sensitivity tests.

The bootstrap sampling method, proposed by Efron and Tibshirani (1993), was used to obtain coefficient estimates and their standard deviations by generating multiple resampled datasets from the original data. The model was adjusted for each of these resampled datasets. This allows estimation of the variability of the model coefficients. The bootstrap results show that the means and standard deviations of the coefficients are consistent with those obtained from the original model, reinforcing its robustness. Sensitivity tests were conducted by removing one observation at a time from the dataset and adjusting the model to the remaining subset. This allows for evaluating the influence of each observation on the model's results. The results of the sensitivity tests show that the means and standard deviations of the model coefficients are consistent, suggesting that the model results are not influenced by individual observations.

Although the AIC and BIC values are not the lowest for the GMM model, the number of significant parameters and the model's ability to correct for autocorrelation and heteroskedasticity support its selection as the most robust and consistent. Cross-validation, bootstrap sampling, and sensitivity tests demonstrated that the estimated coefficients are stable and reliable. The model was further evaluated through Wald tests and Granger causality tests to verify the significance and causality of the explanatory variables. These tests confirmed that lagged business perceptions of future sales, prices of goods and services, and national demand have a significant impact on the future employment rate in the Araucanía region.

5. Discussion

The study results confirm that past business perceptions significantly impact the future employment rate in the Araucanía region. The positive association between perceptions of future sales and service prices with the employment rate indicates that optimistic expectations about economic performance encourage proactive hiring decisions. This finding aligns with previous studies such as those by Khan and Upadhayaya (2019) and Dasgupta and Lahiri (1993), which demonstrated that business confidence can influence investment

and employment decisions, reflecting expectations about the future economic environment.

On the other hand, the negative coefficients for perceptions of national demand suggest that overconfidence in future demand may lead to less cautious hiring decisions. This result is consistent with research by Taylor and McNabb (2007) and Lahiri et al. (2016), who found that high perceptions of national demand do not always translate into immediate employment increases due to potential overestimation of future demand. Additionally, these findings reflect the studies by Leeper (1992) and Matsusaka and Sbordone (1995) on the relationship between consumer confidence and economic performance, suggesting that expectations significantly influence business decisions.

The robustness of the IV and GMM models in addressing issues of endogeneity and autocorrelation strengthens the validity of the findings. Lucas and Rapping (1969) and Phelps (1967) established that inflationary expectations influence employment and wage decisions, which aligns with the evidence that business expectations of future prices affect the labor market. Green (2022) and Hille and Schupp (2019) also found that expectations of service prices influence hiring, suggesting that firms adjust their staffing strategies based on anticipated future income.

The detailed analysis using the IV-GMM approach showed that perceptions of future sales, future investment, and service prices have significant and positive coefficients, indicating that companies anticipating better economic conditions tend to hire more personnel. The application of advanced econometric models such as ARDL, OLS, IV, and GMM follows methodologies established by authors such as Pesaran and Shin (1999) for ARDL, Wooldridge (2010) for OLS and IV, and Hansen (1982) for GMM, ensuring the robustness and consistency of the estimates. These approaches adequately address issues of endogeneity, heteroskedasticity, and autocorrelation in the data, providing a more solid interpretation of the effects of business perceptions on the future employment rate in the Araucanía region. Together, these results highlight the importance of monitoring and understanding business perceptions to improve employment strategies and economic policies in the Araucanía region. Business perceptions not only reflect current economic conditions but also expectations

about the future, which are crucial for strategic planning and business decision-making.

6. Conclusions

The results of this study underscore the importance of considering the measurement of past business confidence to analyze the future employment rate in the Araucanía region. The evidence suggests that optimistic expectations about future sales, increased investment, a higher number of workers, and service prices drive hiring decisions, while overconfidence in national demand may have adverse effects. These findings reinforce the relevance of using robust econometric models such as IV and GMM, which address problems of endogeneity and autocorrelation, providing more accurate estimates. Consequently, the need to closely monitor business perceptions is highlighted in order to formulate effective employment strategies and economic policies. The application of these methods in future studies will allow for a deeper understanding of the dynamics between business confidence and employment, contributing to regional economic development. These results also suggest that policies promoting greater transparency and economic stability can improve business perceptions and confidence, and consequently, the employment rate. Araucanía, with its particular economic dynamics, would especially benefit from studies that explore the relationship between transparency, expectations, business confidence, and employment, thus providing a solid foundation for regional economic policy and development strategies. Moreover, the need for continued research is emphasized to better understand how business expectations and confidence across different economic aspects interact and affect employment, which will significantly contribute to improved economic planning and public employment policies in the region.

7. Bibliography

- [1] Adekoya OB, Oliyide JA. Impact of economic policy uncertainty and oil price shocks on growth: Evidence from OECD countries. *Energy Economics*. 2021;98:1051-1064.
- [2] Angrist JD, Pischke JS. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton: Princeton University Press; 2009.

- [3] Dasgupta S, Lahiri K. Predicting turning points with leading indicators: An empirical investigation. *International Journal of Forecasting*. 1993;9(3):357-368.
- [4] Efron B, Tibshirani RJ. *An Introduction to the Bootstrap*. Boca Raton: Chapman & Hall/CRC; 1993.
- [5] Ghosal V, Ye Y. Uncertainty and the employment dynamics of small and large businesses during recessions. *Journal of Technology Transfer*. 2015;40(5):874-888.
- [6] Granger CWJ. Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. *Econometrica*. 1969;37(3):424-438.
- [7] Green M. Service prices and labor market dynamics: Evidence from cointegration analysis. *Economic Letters*. 2022;178:110-125.
- [8] Hansen LP. Large sample properties of generalized method of moments estimators. *Econometrica*. 1982;50(4):1029-1054.
- [9] Hille P, Schupp J. Expectations of service prices and labor market decisions: A cointegration approach. *Applied Economics*. 2019;51(10):1043-1057.
- [10] Khan MS, Upadhayaya R. The predictive power of business confidence for investment growth in the United States. *Journal of Economic Studies*. 2019;46(2):178-194.
- [11] Lahiri K, Monokroussos G, Zhao Y. The role of consumer confidence in forecasting consumption and investment: A comparison of methods. *International Journal of Forecasting*. 2016;32(3):867-883.
- [12] Leeper EM. Consumer sentiment and the economic outlook. *Brookings Papers on Economic Activity*. 1992;1992(1):89-145.
- [13] Lucas RE, Rapping LA. Real wages employment and inflation. *Journal of Political Economy*. 1969;77(5):721-754.
- [14] Matsusaka JG, Shordone AM. Consumer confidence and economic fluctuations. *Economic Inquiry*. 1995;33(2):296-318.
- [15] Pesaran MH, Shin Y. An autoregressive distributed lag modelling approach to cointegration analysis. En: *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*. Cambridge: Cambridge University Press; 1999.
- [16] Phelps ES. Phillips curves expectations of inflation and optimal unemployment over time. *Economica*. 1967;34(135):254-281.
- [17] Taylor MP, McNabb R. Business confidence and business cycles in the United States. *Review of Economics and Statistics*. 2007;89(2):293-307.
- [18] Wald A. Tests of Statistical Hypotheses Concerning Several Parameters When the Number of Observations is Large. *Transactions of the American Mathematical Society*. 1943;54(3):426-482.
- [19] Wooldridge JM. *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press; 2010.

Analysis Of Efficiency And Sustainable Management Of Urban Solid Waste (Msw)

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Abstract

The growth of the world population and consumption habits leads to an increase in waste generation. According to the World Bank (1), if no action is taken, urban solid waste will increase by 50% by 2050. Possible actions focus on two areas: changing consumption habits on one hand, and reusing waste for a second use to avoid using new resources on the other. In the first case, current consumption habits have existed for a long time and represent a structural situation that is difficult to change in the short term. This requires actions in education, public awareness, and legislation. Waste treatment has evolved in Europe over the years, moving from uncontrolled dumping to incineration, composting, or anaerobic digestion to produce biogas. The last two are inefficient solutions because they waste valuable components in the organic fraction of both municipal and industrial waste. In both cases, microplastics are present in biogas digestate (2) and in the compost from municipal organic waste (3). Also, the potential use of pyrolysis as a source of energy generation, gray and green hydrogen, and microplastic removal is not taken advantage of. According to European regulations, landfill disposal must be reduced to 10% by 2035. This is important because, in 2020, Spain had a landfill rate of over 50% (4). On the other hand, the energy crisis caused by the Russian invasion of Ukraine has led to a significant increase in biogas plants in Spain. In fact, by December 2023, there were only 10

biogas plants, but it is estimated that more than 2,300 plants could be built, covering 45% of the national demand (5). This will cause a high demand for waste and an excess of digestate, which is difficult to use in agriculture. The objective of this study is to provide an approach based on waste evaluation. Depending on its fat and carbohydrate content, it will determine the viability of its use and adopt a specific strategy before implementing solutions such as composting or anaerobic digestion. For the remaining organic matter, processes are proposed to prevent plastics from reaching the soil. Efficient waste characterization will help identify high-value products.

Keywords: Waste management, Pyrolysis, Hydrogen, Biogas, MSW.

1. Introduction

Optimization strategies for recycling and reuse have always been aimed at source separation, meaning that the waste generator separates waste into major categories—known as selective collection:

Paper and Cardboard: Blue container.

Packaging: Yellow container.

Glass: Green container.

Organic waste: Brown container.

In Spain, the selective collection of urban waste in 2021 amounted to 5.6 million tons, representing less than 25% of the total (6). Furthermore, this selective collection includes a high percentage of contaminants, which hinders recycling and/or recovery. The targets set by European regulations for 2035 are certainly ambitious, limiting landfill disposal to just 10%.

The Russian invasion of Ukraine led to an energy crisis due to the disruption in oil product supplies, highlighting the weakness of a strategy based on Europe's inexplicable geostrategic decision to rely on Russian gas as the foundation of its energy policy. Biogas had not been developed at all in Spain, mainly due to administrative barriers and the influence of the gas lobby that prevented its growth. In fact, by December 2023, there were only 10 biogas plants in Spain. This situation has since changed, and it is now estimated that Spain could

support more than 2,300 biogas facilities, which would cover 45% of the national demand (5).

These would be biogas plants not intended for electricity generation but rather for injecting methane into the grid after undergoing an upgrading process. Biogas contains about 60% methane; to be injected into the gas network, this content must exceed 90%. With this regulatory framework and the high expectations, the biogas boom could lead to competition for waste, potentially resulting in fraudulent use of non-waste materials for methanization. The large number of biogas plants is also expected to result in an oversupply of compost and digestate.

4. Current Uses of Organic Matter from MSW and Industrial Sources

Traditionally, the primary use of the organic fraction of municipal solid waste (MSW) has been agricultural composting. In less developed societies, this is the main destination, accounting for 56% of waste, while in more developed countries this figure is around 32% (1). As development increases, the waste composition changes, with more non-compostable elements appearing. These must either be physically separated or sent to landfills.

Mechanical-Biological Treatment Plants

Mechanical-biological treatment (MBT) plants aim to separate the different fractions of MSW such as plastics, metals, or glass, as well as the organic fraction, which is composted, reducing weight and volume by approximately 40–50%. During this process, the organic matter decomposes, emitting CO₂ and generating water.

Unfortunately, this compost often contains many contaminants, typically macro- and microplastics, making it unsuitable for agricultural use. At the very least, these plants avoid direct landfill disposal, reducing waste and preventing fermentation and leachate formation. However, they do not fully utilize the potential of the included compounds.

Biogas

Using the organic fraction of MSW to produce biogas is a clear example of resource recovery and reintegration into the economic

cycle. Anaerobic digestion yields a mixture of CO₂ and methane, along with digestate that can be used as fertilizer.

Initially, biogas plants used cogeneration to convert the gas into thermal energy for internal use and electricity injected into the power grid. This model was supported by subsidies for each kWh generated. When the regulatory framework changed and subsidies decreased, the business model became unviable.

Following the crisis in Russian gas supply, biogas plants are now being developed to inject gas into the national grid. This involves upgrading the methane from about 60% to a commercial-quality natural gas of over 98%. It is estimated that up to 45% of national natural gas demand could be met from renewable sources.

This approach is better than biological treatment alone, as it yields two products that can be reintegrated into the production process—whereas before, the focus was only on reducing landfill. However, valuable components such as lipids and carbohydrates are still not utilized, and the problem of microplastics in the digestate remains.

From a commercial standpoint, while the produced methane is in demand and its price is set on international markets, digestate—used only as agricultural fertilizer—faces greater marketing challenges. The large number of biogas plants will create a high supply that the market may struggle to absorb, potentially threatening the viability of these plants.

Moreover, considering digestate as fertilizer is somewhat risky, as it often lacks a balanced NPK ratio, stabilized organic matter, or suitable soil microbiota. It may also contain high levels of metals, salts, or microplastics.

Composting

Materials suitable for direct composting may come from MSW, as long as selective collection is in place. Regulatory frameworks promote the selective collection of MSW, especially in industrial and hospitality settings. This waste can produce high-quality compost. However, in the medium to long term, the high volume of digestate from biogas plants—direct competitors—may hinder its commercialization due to market saturation.

At the same time, the difficulty in separating plastics from organic matter highlights the presence of macro- and microplastics in this application, which ultimately end up in the soil.

Uncontrolled Incineration

Although uncontrolled incineration of MSW is nearly nonexistent in Europe, it is common in underdeveloped and developing countries. This practice severely impacts soil, water, and air quality in affected areas and has negative health effects.

Incineration contaminates the soil with ash and by-products, including plastics and metals, reducing fertility and introducing toxins into the food chain. These pollutants can also leach into and harm groundwater. Volatile ash settles in the soil and washes into rivers with rainfall, affecting aquatic life. Additionally, the combustion emits toxic compounds like dioxins and furans, harming human and animal health.

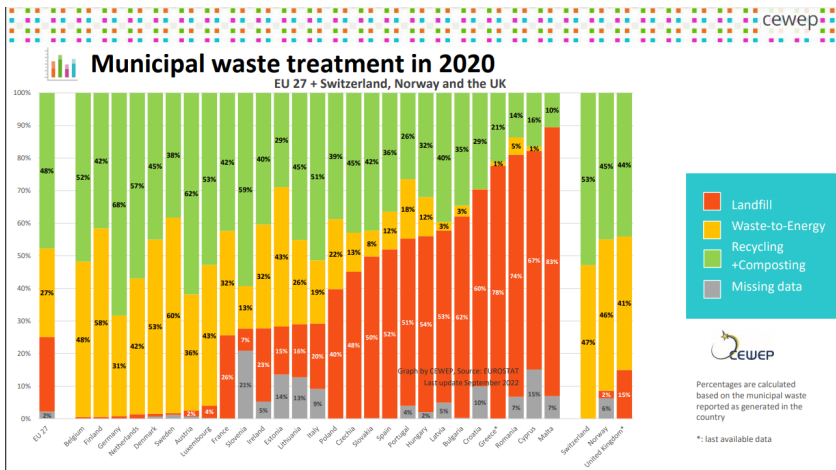
Incineration in Waste-to-Energy Plants

This involves controlled incineration in a specially designed facility, avoiding toxic emissions through bag filters or electrostatic precipitators. However, a suitable regulatory framework is essential to prevent potential emission risks (7).

While this was the best available technique in the 1980s and 1990s, it is no longer the most efficient. In 2020, the European average for incineration was 27%, with 23% going to landfill and 48% to recycling and composting. Specifically, incineration rates in Northern Europe range from 30% to 60%, while Southern and Eastern European countries often exceed 50% landfill rates.

It can be considered a “necessary evil” since incineration has helped Northern European countries reduce landfill use to negligible levels. In contrast, countries like Spain still send about 50% of waste to landfills, as shown in the graph below. It is essential that these facilities have appropriate post-combustion treatment to prevent emissions of dioxins and furans.

Figure 1.



(4)

Waste Exports

The European Union exports around 32 million tons of waste, the majority of which is ferrous metals and paper. Nearly 40% goes to Turkey, followed closely by India, the United Kingdom, Switzerland, and Norway (European Parliament, 2024).

Figure 2.



(8)

Most of this waste was sent to countries with very permissive legislation regarding waste treatment and disposal. For example, ferrous waste is exported to Turkey or India, while at the same time new ferrous metals are imported from these same countries. On the other hand, there are countries with more advanced technology to transform waste into new resources.

A special mention should be made of obsolete electronic equipment. Basel Action Network tracked disused electronic devices and found that 19% of them—extrapolated to approximately 350,000 tons—are sent to developing countries, where they end up in landfills or are subjected to unsafe treatment processes, causing environmental damage (9).

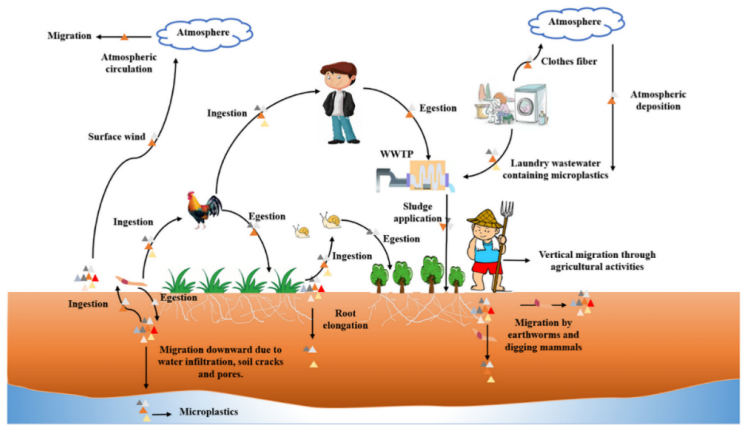
Plastics, Microplastics, and the Trophic Chain

Current uses of the organic fraction of municipal solid waste (MSW) are leading to an increasing presence of microplastics in the soil, air, and even the sea. The relevance and potential negative effects of these pollutants are still not fully understood. However, growing interest in this topic is evident, as reflected by the number of scientific publications on the subject. In fact, only 52 papers on microplastics were published worldwide in 2009, while in 2019 that number rose to 1,208 (10).

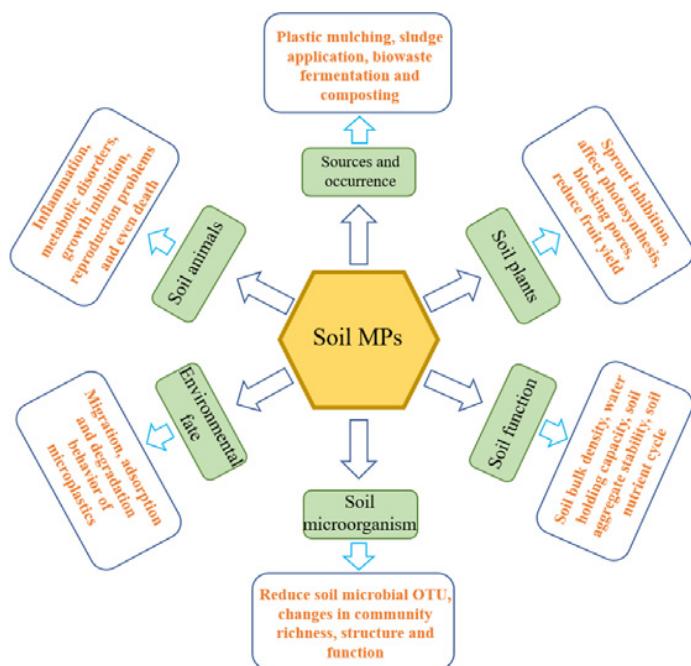
Microplastics in Soil

The following diagram shows the origins, destinations, and propagation vectors of microplastics from the soil.

Figure 3.



The graph below also includes the effects of microplastics in the soil.



(11)

To analyze the origin of microplastics in soil, several sources can be identified:

Composting. The fertilizer resulting from the composting of the organic fraction of organic waste contains between 5 and 20 particles smaller than 5mm in diameter per gram. Five polymers account for 94% of these, listed by abundance: polyethylene, polystyrene, polyester, polypropylene, polyvinyl chloride, and acrylic polymers (3).

Agricultural plastic use and misuse.

Sewage sludge used for compost.

Biogas digestate.

Treated water that returns to rivers and is reused in agriculture and human consumption.

Although the effect of microplastics on crop development is a topic that requires further study, empirical trials have shown negative impacts on plant growth (12). According to several authors, impacts on soil are linked to changes in its physicochemical properties, including a reduction of 8% in organic matter, 13.10% in total nitrogen, 17% in phosphorus, 6.7% in potassium, 5.4% in porosity, 8.9% in moisture, and a 23% reduction in surface water infiltration. These changes directly affect soil fertility and, consequently, agricultural yields.

Microplastics can release chemical additives that may affect soil microorganisms. This type of pollution can also act as a vector for new microorganisms that alter the microbiota and its processes (13).

Soil characteristics, along with human activities, directly influence microplastic migration. Irrigation or rainfall infiltration is the main cause of vertical migration. Microplastics may also migrate due to external forces like wind and can remain suspended in the atmosphere. Earthworms also play a key role in this migration, facilitating their entry into the food chain. Additionally, due to their high hydrophobicity, microplastics can concentrate pollutants in the soil such as fungicides, pesticides, and even heavy metals (11).

Microplastics in Water

Microplastics in rivers, seas, and oceans enter the food chain with evident negative consequences. The best way to prevent this pollution is by tackling it at the source—improving selective waste collection and recycling, and reducing landfill disposal (14).

6. Alternative Energy Recovery

Depending on the composition of the organic fraction of municipal solid waste (MSW)—specifically its moisture, fat, carbohydrate content, and residue—various strategies can be applied: fat extraction, carbohydrate fermentation, or pyrolysis of residual waste, which generates energy for the process and possibly an energy surplus.

The final outcome can be one or all of the following by-products:

Fats for biodiesel, HVO, or HEFA-type SAF.

Crude ethanol for bioethanol or Alcohol-to-Jet SAF.

Energy for thermal use or conversion into electricity.

Alcoholic Fermentation of Carbohydrates

If the carbohydrate content exceeds 15%, it makes industrial sense to ferment this organic matter to obtain crude ethanol for various uses.

Ethanol

Ethanol is currently used as a biofuel blend in gasoline, with labeled blends such as E10 or E85 (10% or 85% ethanol respectively), suitable for gasoline or flex-fuel vehicles per manufacturer specifications. It can also be used to produce the gasoline additive ETBE (ethyl tert-butyl ether).

Sustainable Aviation Fuel (SAF)

Ethanol can serve as a precursor for aviation biofuel, known by its acronym SAF (Sustainable Aviation Fuel), through a chemical transformation of the ethanol produced.

Lipid Extraction

Lipid extraction is determined by industrial feasibility. The OFMSW + PLASTIC mix must have a moisture content below 1% for fat extraction to be efficient. Therefore, lipid extraction should occur after carbohydrate fermentation, as that process happens in aqueous media.

Solvent-based lipid extraction is the standard industrial practice, with a minimum fat content threshold of 15%. The resulting lipids can be raw materials for biofuels like biodiesel, HVO, or aviation biofuels.

There is high demand for these lipids, especially in Europe and the USA, as they are derived from sources that do not compete with animal or human food or land use—recycled from the economic cycle.

Biodiesel

Biodiesel is a fatty acid methyl ester. In a basic medium, a reaction known as transesterification occurs in which oil reacts with methanol to generate biodiesel and glycerin. This biodiesel is typically blended up to 7% with mineral diesel and remains compliant with the EN590 diesel fuel standard. Higher concentrations must be labeled blends (e.g., B15 or B30).

Hydrobiodiesel (HVO)

Hydrobiodiesel or HVO (Hydrotreated Vegetable Oil) is a biofuel made from lipids through a hydrogenation process using heterogeneous catalysts. To protect the catalysts, the oil must be highly refined, with phosphorus content below 3 ppm and metal content below 10 ppm.

As oil from waste is not particularly clean, it must undergo strong refining, including degumming to reduce phosphorus and bleaching with activated clays to capture heavy metals.

HVO production involves refined lipids and hydrogen to produce fully saturated fatty acids (paraffins or HVO) and biopropane as a by-product.

HEFA/SAF Aviation Biofuels

HEFA (Hydrotreated Esters and Fatty Acids) is the SAF variant for aviation. Starting with HVO, processes such as isomerization, cracking, and fractionation are performed to obtain fuels compatible with aviation fuel standards like DEF-STAN 91-091 or ASTM D7566.

For now, aviation decarbonization relies solely on SAF liquid biofuels. Other technological alternatives like electrification are currently unavailable or impractical for commercial and military aviation demands.

Pyrolysis

Pyrolysis of organic and plastic MSW is an energy source that produces syngas or pyrolytic liquids suitable for energy use. The final product, biochar, can be used as an adsorbent, soil enhancer, or for combustion.

Unlike composting and biogas, pyrolysis eliminates the contribution of macro and microplastics to soil and water. Thus, waste treated through pyrolysis ceases to be a source of plastic pollution.

Pyrolytic Gasification

Pyrolytic gasification is a form of pyrolysis in which the material is heated in the absence of oxygen, causing the organic matter and plastics to break down into synthesis gas. This gas can be combusted for energy or used to generate electricity.

Its main advantage over traditional combustion is the absence of dioxin and furan emissions, which require costly post-combustion treatments such as bag filters, electrostatic filters, or high-temperature oxidizers to eliminate VOCs.

Typical synthesis gas composition:

Carbon monoxide (CO): 20%–40%

Hydrogen (H₂): 25%–40%

Carbon dioxide (CO₂): 15%–25%

Methane (CH₄): 5%–15%

Light hydrocarbons (C_xH_y): 0%–10%

Water vapor (H₂O): 0%–10%

Nitrogen (N₂): 0%–15%

Hydrogen, methane, and light hydrocarbons contribute the calorific value of syngas. Whether hydrogen is classified as “green” or “gray” depends on regulatory frameworks, but if plastic is prevented from ending up in the soil, this represents both energy recovery and environmental improvement.

2. Conclusions

Although current MSW (Municipal Solid Waste) management models are progressively reducing landfill disposal, they are clearly insufficient, as the EU still sends 38% of its waste to landfills, and in Spain the percentage is even higher at 52%.

The proposed model improves composting performance, as this process emits CO₂ through a decomposition from which no value is derived. Additionally, it helps reduce the input of micro- and macroplastics into the soil. The biogas process is also optimized: on one hand, all the energy contained in oils and fats is utilized instead of being consumed in an anaerobic fermentation process; on the other hand, carbohydrates are transformed into ethanol, a product with greater added value than biogas. Furthermore, the new process eliminates the dumping of polluting plastics into the soil.

This model incorporates four processes that offer greater commercial and environmental value, producing the following outputs:

Lipid extraction → For use in biodiesel, HVO, or SAF.

Alcoholic fermentation → Ethanol production.

Pyrolysis → Hydrogen, synthesis gas, and combustible pyrolytic liquid.

This is a more economically efficient approach compared to current practices such as composting, bio-stabilization, and biogas production, as it enables the generation of high-value compounds that are also in high demand in today's society. It also drastically reduces the release of microplastics into the environment—and consequently into the food chain a growing and difficult-to-solve problem. Beyond the lipids and carbohydrates used for traditional biofuels (ethanol and biodiesel/HVO), the truly disruptive element is the generation of hydrogen from waste.

It is worth highlighting that any decarbonization strategy must include hydrogen, as it is a clean alternative to fossil fuels in hard-to-abate sectors such as heavy industry (e.g., metallurgy), long-distance transport, and even aviation. Its combustion does not generate CO₂, and when derived from renewable sources, it significantly reduces emissions.

Although green hydrogen, produced via electrolysis using renewable electricity, is key to a decarbonized economy, its current production is expensive and comes with a significant opportunity cost. This is because the renewable electricity used to generate hydrogen could be directed to the grid or to other, more economically efficient uses.

In this context, the development of less costly alternative technologies for hydrogen production—such as the pyrolysis of waste or industrial by-products offers a complementary and competitive pathway to accelerate decarbonization without putting additional strain on the renewable electricity system.

3. Bibliography

- [1] Banco Mundial. Informe Desechos Banco Mundial. [Online]; 2018. Disponible en: HYPERLINK “file:///C:/Users/Raúl%20SG\\AppData\\Local\\Microsoft\\Windows\\INetCache\\Content.Outlook\\ONF7CB9P\\www.bancomundial.org” www.bancomundial.org .
- [2] Öling-Wärna V, Akerback N, Engblom S. Digestate from Biowaste and Sewage Sludge as Carriers of Microplastic into the Environment: Case Study. *Water Air Soil Pollutant*. 2023;(234).
- [3] Edo , Fernández-Piñas F, Rosal R. Microplastics identification and quantification in the composted Organic Fraction of Municipal Solid Waste. *Science of the Total Environment*. 2022; 813.
- [4] Confederation of European Waste-to-Energy Pl. Municipal waste raport. [Online]; 2022. Disponible en: <https://www.cewep.eu> .
- [5] Ortiz de Mendibil Romo N. Sedigas. [Online]; 2023. Disponible en: <https://www.sedigas.es> .
- [6] INE. Instituto Nacional de Estadística. [Online]; 2023. Disponible en: <https://www.ine.es> .
- [7] Bersi E, Schmidt N. Incineradoras de residuos europeas: las dudas sobre sus emisiones que siguen sin resolverse. [Online]; 2023. Disponible en: <https://www.infolibre.es> .
- [8] Parlamento Europeo. El trabajo de la UE para la gestión sostenible de residuos. [Online]; 2024. Disponible en: <https://www.europarl.europa.eu> .
- [9] Puckett J, Brandt C, Palmer H. Basel Action Network BAN. [Online]; 2018. Disponible en: <https://www.ban.org/> .
- [10] Sorensen RM, Jovanovic B. From nanoplastic to microplastic: A bibliometric analysis on the presence of plastic particles in the environment. *Marine Pollution Bulletin*. 2021; 163.
- [11] Haobo Y, Bo J, Yi X, Tian Z, Mingjie L, Xin W. Recent advances on ecological effects of microplastics on soil environment. *Science of the Total Environment*. 2021; 798.
- [12] Haie G, Qin L, Changrong Y, Karel M, Daozhi G, Jiuxing H, et al. Macro-and/or microplastics as an emerging threat effect crop growth and soil health. *Resources, Conservation & Recycling*. 2022; 186.
- [13] Parsaeimehr A, Miller CM, Ozbay G. Microplastics and their interactions with microbiota. *Heliyon*. 2023; 9.
- [14] García A. ¿Cómo es la sopa de plásticos del Pacífico y quién la ha creado? [Online]; 2018. Disponible en: <https://es.greenpeace.org> .
- [15] Halimatun Saadiah H, Farah NO, Nor'Aini AR, Wakisaka. Innovative conversion of food waste into biofuel in integrated waste management system. *Critical Reviews in Environmental Science and Technology*. 2021.
- [16] Revista digital Retema. ¿Dispone España de instalaciones suficientes para tratar el flujo creciente de biorresiduos recogidos selectivamente? [Online]; 2021. Disponible en: <https://www.retema.es> .

This book offers a comprehensive and up-to-date perspective on the challenges of sustainable development in both global and local contexts, articulating research, innovation, and social commitment from an interdisciplinary approach. Throughout its chapters, it addresses topics such as digital transformation, social entrepreneurship, governance, organizational sustainability, and ecological awareness, demonstrating how scientific and applied knowledge contributes to improving quality of life and strengthening territories. The work integrates diverse methodologies and experiences, becoming a significant contribution to understanding contemporary dynamics and promoting sustainable solutions. It is aimed at students, academics, and professionals interested in generating impact through research and transformative action.