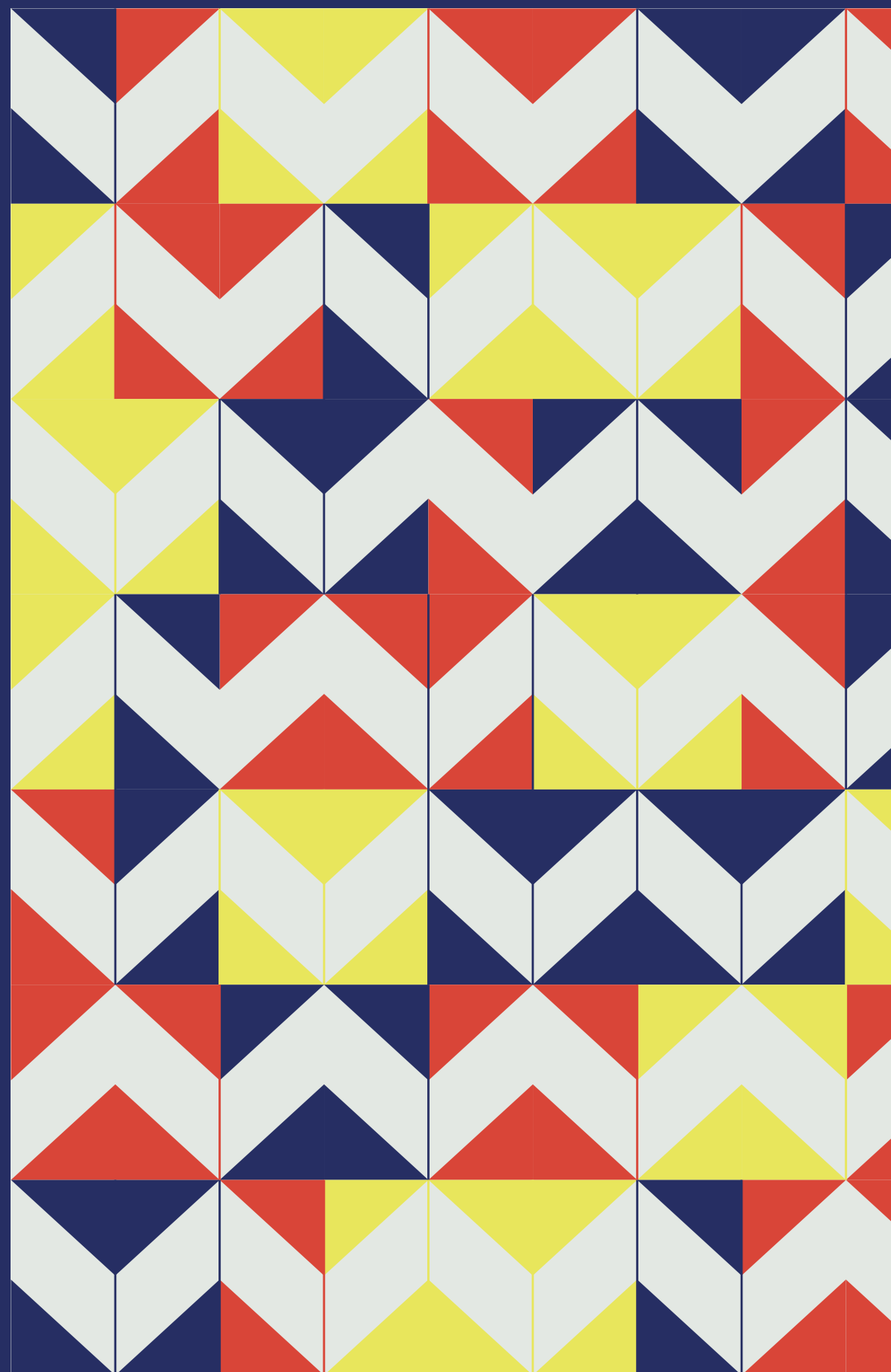




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TABLE OF CONTENTS

1	Editorial— Entrepreneurship beyond boundaries: Towards a relational entrepreneurship perspective	Eduardo Leite
5	A quintuple-helix framework for digital transformation in community pharmacy: Evidence from Portugal	Emanuel Martins
21	From person-centered to person-based care: Implications for organizational ethics and innovation	Carlos Gomes
29	Symbiosis, co-evolution, and relational identity: A holobiont theory of organizational boundaries	Ayşe Yazıcı
46	Intangible cultural heritage, local entrepreneurship, and sustainable tourism in an insular context: The case of Madeira Wine Traditions	Rossana dos Santos António Silva Naidea Nunes
59	Corrective digital intermediation in tourism ecosystems: A conceptual framework for the growth of air passenger rights platforms beyond dynamic packaging	Élvio Camacho Luís Mota
73	Territorial innovation and governance: An integrated RIS4 model for the transition of smart specialisation strategies towards sustainability	Élia Vieira
83	Shipwreck-based blue entrepreneurship in island territories: a case study of <i>El Peñón</i> wreck in Tabaiba, Tenerife. A conceptual and practice-based case study of shipwreck-based blue entrepreneurship in an island tourist coastal territory	Juan López-Arquillo Natalia Reyes Javier Burzaco

EDITORIAL— ENTREPRENEURSHIP BEYOND BOUNDARIES: TOWARDS A RELATIONAL ENTREPRENEURSHIP PERSPECTIVE

Editorial— Entrepreneurship beyond boundaries: Towards a relational entrepreneurship perspective

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1. Entrepreneurship at a Crossroads

For much of the last four decades, entrepreneurship research has been organised around a relatively stable set of analytical coordinates. The entrepreneur, the firm, the opportunity, and the market constituted the principal units through which entrepreneurial phenomena were interpreted. This perspective generated an extensive body of knowledge and profoundly shaped our understanding of innovation, venture creation, and economic development.

Today, the environments in which entrepreneurship unfolds have become considerably more complex.

Climate change, digital transformation, artificial intelligence, demographic transitions, platform economies, health-care innovation, territorial governance, and sustainability challenges increasingly transcend the analytical capacity of isolated firms or individual entrepreneurs. Contemporary entrepreneurial phenomena emerge through interactions between organisations, technologies, institutions, territories, communities, and governance systems that continuously influence one another.

Entrepreneurship is therefore entering a new intellectual phase.

Rather than being understood exclusively as the creation of new ventures, entrepreneurship increasingly represents the capacity to mobilise distributed knowledge, coordinate diverse actors, and generate sustainable value across complex socio-technical ecosystems.

The contributions assembled in this issue collectively point towards what may be developed as a relational entrepreneurship perspective—one that places relational architectures, rather than isolated entrepreneurial actors, at the centre of entrepreneurial value creation.

This perspective does not reject the classical contributions of Schumpeter, Kirzner, Drucker, or the entrepreneurial ecosystem literature. Rather, it extends them by recognising that opportunities, innovation, and competitive advantage increasingly emerge through relational configurations that connect organisations, institutions, technologies, and territories. It is a recognition that the phenomena we study have outgrown the frameworks we inherited—and that theory, like entrepreneurship itself, must be willing to evolve.

2. This Issue: Relational Entrepreneurship in Practice

The contributions assembled in this issue illustrate—from different angles and with different methods—the relational logic that runs through this editorial.

One contribution reminds us that digital innovation cannot be separated from the ethical recognition of the person. The transition from person-centred to person-based care is not merely a clinical refinement—it is a philosophical repositioning that challenges us to ground innovation in human dignity rather than procedural compliance, as discussed by Costa Gomes in this issue. In an era of accelerating technological change, this ethical grounding becomes not optional but foundational.

Another contribution demonstrates that digital transformation in community pharmacy is ultimately a problem of governance rather than technology. The Quintuple Helix framework reveals that transformation emerges through the interaction between leadership, culture, strategic management, customer experience, and sustainability—not through technological adoption alone, as demonstrated by Martins in this issue. Innovation, it appears, is never merely about tools; it is always about people, relationships, and the institutional contexts that enable or constrain their agency.

A third contribution reconceptualises organisational boundaries through the biological notion of the holobiont, challenging the assumption that organisations should be understood as closed, jurisdictional entities. Boundaries, in this view, are not drawn once and defended, but continuously negotiated through symbiotic interaction. Organisational identity is not a stable property to be protected but an emergent outcome of co-evolutionary processes, as proposed by Yazıcı in this issue.

Further contributions extend this relational logic across different domains. Intangible cultural heritage reveals how cultural identity, linguistic proximity, and entrepreneurial opportunity become inseparable in island territories, as examined by dos Santos, Silva and Nunes in this issue. An artificial shipwreck in Tenerife demonstrates how a single submerged asset can activate value chains linking diving, training, conservation, and local entrepreneurship, as illustrated by López-Arquillo, Reyes and Burzaco in this issue.

The conceptualisation of corrective digital intermediaries—platforms that convert passengers' latent legal entitlements into enforced outcomes—identifies a new category of digital venture whose opportunities emerge from institutional failures rather than traditional market gaps. Camacho and Mota, in their contribution to this issue, demonstrate how these firms operate outside the conventional tourism value chain, responding to different problems, occupying different phases of the consumption cycle, and creating value through different mechanisms than distribution platforms. Their four-layer generative mechanism—structural volatility, regulatory entitlement, enforcement gap, and platform scalability—illuminates how entrepreneurial opportunities can emerge at the intersection of market failure and institutional design, reinforcing the relational logic that runs through this issue.

The Integrated RIS4 Synthesis Model further demonstrates that territorial innovation increasingly depends upon collaborative governance structures capable of connecting institutions, regional assets, and sustainability objectives, as discussed by Vieira in this issue.

What unites these contributions—spanning bioethics, digital transformation, cultural heritage, blue entrepreneurship, organizational theory, regulatory entrepreneurship, and regional innovation—is a shared recognition that entrepreneurship is never merely an economic phenomenon. It is always also a social, ethical, and ecological phenomenon, embedded in relationships of power, trust, and mutual dependence.

3. Towards Relational Entrepreneurship

Taken together, these converging insights suggest that entrepreneurship research must attend more systematically to the relational architectures through which value is created. The traditional boundaries separating firms from environments, technology from society, innovation from ethics, and economic development from territorial sustainability are becoming increasingly permeable.

Relational entrepreneurship—as a perspective—does not replace existing theories but repositions them. It suggests that competitive advantage increasingly emerges not from what organisations possess, but from the quality of the relationships and ecosystems in which they participate, as suggested by Yazıcı in this issue.

This perspective has significant implications for how we understand entrepreneurial ecosystems. If value is co-created through interaction, then the quality of relationships—trust, mutual transformation, distributed governance—becomes as important as the quantity of resources. The resilience of entrepreneurial systems depends less on the strength of individual actors than on the diversity and depth of their symbiotic engagements (Graça & Leite, 2026).

This also has implications for how we evaluate entrepreneurial success. Traditional metrics—profit, growth, survival—capture only part of what matters. If entrepreneurship is fundamentally relational, then success must also be measured by the quality of the relationships it sustains: the trust it builds, the communities it strengthens, the ecological systems it regenerates, and the human dignity it respects (Costa Gomes, 2023).

This perspective resonates with Granovetter's (1985) argument that economic action is socially embedded, extending the notion of embeddedness towards entrepreneurial systems characterised by co-evolution, governance, and distributed value creation. This evolution is also consistent with the gradual shift from firm-centred competition towards ecosystem-based value creation (Moore, 1993).

A relational entrepreneurship perspective also invites new methodological approaches capable of capturing interaction, co-evolution, and multi-level dynamics, complementing the traditional focus on individual entrepreneurs or single firms. This methodological pluralism—embracing network analysis, process studies, comparative case designs, and longitudinal approaches—is essential for understanding how entrepreneurial

value emerges through relational configurations rather than isolated actions.

4. An Emerging Research Agenda

The articles in this issue do not merely illustrate these arguments; they also suggest directions for future inquiry.

If relational entrepreneurship is a generative perspective, then several questions become pressing. How do entrepreneurial relationships become constitutive—transforming participants rather than merely connecting them, as suggested by Yazıcı and Costa Gomes in this issue? Under what conditions do relational architectures generate resilience rather than fragility, as explored by Vieira and by Camacho and Mota? How do governance structures shape the quality of symbiotic engagements, as discussed by Martins and Costa Gomes? And how can we design entrepreneurial ecosystems that are not only efficient but also just, inclusive, and ecologically sustainable, as illustrated by the contributions of dos Santos and colleagues, López-Arquillo and colleagues, and Camacho and Mota?

These questions are not merely academic. They speak directly to the challenges facing entrepreneurial ecosystems in an era of rapid technological change, deepening ecological crisis, and widening social inequality. The frameworks developed in these pages—the holobiont theory of organizational boundaries, the corrective digital intermediary, the integrated RIS4 synthesis model, the quintuple helix in community pharmacy—offer tools for addressing these challenges.

The geographical diversity of this issue—with authors from Portugal, Turkey and Spain—reflects the journal's growing international reach and its capacity to attract contributions from different scholarly traditions and institutional contexts. The theoretical diversity is equally significant. From bioethics to biomimetics, from cultural heritage to regulatory entrepreneurship, the contributions to this issue demonstrate that entrepreneurship research is not a single discipline but a meeting point for multiple intellectual traditions. It is precisely at these intersections that the most interesting questions emerge.

5. Conclusion: The Next Frontier of Entrepreneurship Research

Entrepreneurship has always been concerned with creating new possibilities. The challenge before contemporary scholarship is to understand how those possibilities emerge within increasingly interconnected systems where technological progress, institutional capacity, ecological sustainability, and human dignity are inseparable.

If the twentieth century sought to explain how entrepreneurs create firms, the twenty-first century will increasingly be judged by its ability to explain how entrepreneurial systems create sustainable futures. The transition is not from one or-

organisational form to another but from one way of seeing organisations to another.

The contributions assembled in this issue represent one contribution to that broader conversation. The frameworks developed in these pages—the holobiont theory of organizational boundaries, the corrective digital intermediary, the integrated RIS4 synthesis model, the quintuple helix in community pharmacy—are not merely academic exercises. They are tools for understanding and shaping a world in which entrepreneurship is increasingly recognised as a relational, responsible, and regenerative phenomenon.

If entrepreneurship research is to remain relevant in the decades ahead, it must increasingly explain not only how entrepreneurs create value, but how relationships, institutions, and ecosystems sustain it. That, perhaps, is the next frontier of entrepreneurship research.

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A QUINTUPLE-HELIX FRAMEWORK FOR DIGITAL TRANSFORMATION IN COMMUNITY PHARMACY: EVIDENCE FROM PORTUGAL

A quintuple-helix framework for digital transformation in community pharmacy: Evidence from Portugal

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ABSTRACT

Community pharmacies (CP) are increasingly adopting digital technologies that reshape operations, stakeholder coordination, and patient-facing services. Yet, research on digital transformation (DT) in community pharmacy remains fragmented and often lacks a management-oriented integrative framework. This study proposes and empirically explores an adapted Quintuple Helix model for DT in community pharmacy, translating the canonical helixes into five managerial dimensions: leadership and culture, technology, strategic management (including regulation), customer experience, and sustainability. We conducted eight semi-structured interviews with (i) pharmacy owners/technical directors and (ii) professionals from technology firms serving the community-pharmacy channel in Portugal. Data were analysed through theory-driven thematic coding using MAXQDA. Findings support ten operational propositions linking Enterprise Resource Planning (ERP) maturity, interoperability, cybersecurity and in compliance with the General Data Protection Regulation (GDPR), digital channels, analytics dashboards, financing strategies, and paperless/energy efficiency initiatives to service quality, operational efficiency, customer outcomes, and Environmental, Social and Governance (ESG) perception. The framework clarifies the multi-actor nature of DT in community pharmacy and offers actionable KPIs for monitoring progress. Implications are discussed for pharmacy managers, technology providers, and policymakers, alongside limitations and directions for comparative and longitudinal research.

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1. Introduction

This article addresses a reality marked by reconfigurations and challenges that require a redefinition of the operational and organizational paradigms of contemporary society. The continuous development of advanced integrated circuit (chip) electronic systems opens up a portal of discoveries in areas such as Quantum Computing, driving gains in energy efficiency and structural performance.

Digital Transformation has revolutionized the *modus operandi* of interaction in society at an accelerated pace.

The world of work is constantly changing in a competitive and complex environment that demands ever greater adaptability and tenacity. New digital tools are not just transforming processes: they are creating entirely new realities. Progressing in this environment requires more than just occasional innovation—it requires strategic vision and the ability to turn threats into competitive advantages.

This scenario became more apparent when the COVID-19 pandemic prompted organizations to invest more in digital transformation (Hanelt et al., 2021).

In Portugal, digital transformation has been led by organizations in the technology, finance, and healthcare sectors, which are adopting advanced digital technologies to take their products/services to the next level. This progress is supported by government initiatives such as the National Strategy for Economic Digitization and the Industry 4.0 initiative. Nevertheless, asymmetries and structural challenges remain (Ribeiro, 2023).

This article fits into this context, focusing on the impact of digital transformation on the overall management of community pharmacies in Portugal. It is a sector that has been incorporating new digital technologies that are reshaping not only its operational processes—prescriptions, stock management, clinical support—but also the very role of the pharmacist in the healthcare chain.

Over time, we have witnessed a gradual transformation driven by technological innovations, some of which are already commonplace in the sector, such as proprietary software for the individualized preparation and dispensing of drugs, the use of diagnostic and therapeutic aids, robotization, and chatbots that contribute to greater operational capacity – personalized patient care, scientific assistance to pharmacists, real-time logistical and financial tracking, energy efficiency, home delivery service, and commercial aspects (promotional campaigns, inventory and current account management) – optimizing strategic decision-making, thereby minimizing potential errors and reducing costs, as well as providing better service to patient care. As a result, there is an increase in terms of loyalty and reputation, leading to a more professional and modern environment.

Advances in new technological tools, such as Artificial Intelligence (AI), Blockchain, Internet of Things (IoT), and

online analytical platforms are restructuring pharmaceutical services and health education (Almeman, 2024). With the emergence of the Industrial Revolution 4.0 and the appearance of the concept of Health 4.0, the idea of exploring a new service (pharmacy 5.0) has developed, which includes mobile systems, with the aim of expanding business and providing a new service to the community, such as mobile digital pharmaceutical counselling and programs focused on health and fitness (Barata et al., 2022).

In fact, with the increase in global data traffic, economies are integrating advanced information systems—5G technology—fifth-generation wireless communication technology—enabling the viability, expansion, and connectivity of digital information technologies that are transforming traditional paradigms. This advanced information system has made it possible for robotic surgeries to exist today, for patients to be monitored through electronic devices (wearables) that have the ability to continuously provide data on key indicators, such as blood pressure, heart rate, and glycemia data. (Devi et al., 2023).

In this sense, the future of organizations increasingly depends on this new technological revolution that drives sustainable business practices, aiming to achieve better performance and competitive advantage (Jovane et al., 2008). Thus, in the pharmacy channel, continuous digital transformation generates potential benefits and value creation, since there are new consumption dynamics and nowadays the pharmacy is more than just a place where medicines are dispensed; it is also considered a hub for healthcare, beauty, and well-being.

The ability to monitor and explore niche markets and anticipate future trends, transforming simple observations into innovative business strategies, is a differentiating factor (Leite et al., 2024).

Digital transformation is a complex, multifaceted, and dynamic process in which an organization incorporates changes resulting from digital technology and innovation in all areas.

It is a change that transcends the simple integration of new tools and involves a profound evolution in the culture, leadership, processes, and strategies of an organization and in entrepreneurship, aiming to improve efficiency, the value delivered to the customer, and constant adaptation to new opportunities in an increasingly connected and digital global market (Bonnet & Westerman, 2021).

In academic literature, there are several definitions of DT, including a wide variety of concepts and dimensions. Authors such as Bharadwaj et al. (2013), Sebastian et al. (2017), Li (2020), and Kraus et al. (2021) have a strongly technological view of DT on organizational structures. In contrast, authors such as Pousttchi et al. (2019), Vial (2019), Verhoef et al. (2021), and Schilirò (2022) integrate a holistic and multidimensional perspective beyond the technological component.

A critical point for most of the authors referenced is the fact that there is no in-depth approach to the three pillars of sustainability.

According to Nadkarni and Prügl (2021), DT lacks both technology and people, which are intrinsically and symbiotically linked.

Value creation should be the main objective of a business organization, as this is the only way to achieve sustainable competitive advantage. According to Schwartz (2001), over time it has become clear that digital technology is the future of all movements in society, and it is important for organizations to consider digital transformation in their businesses, since it is predicted that companies that fail to adapt to the digital world will be victims of “Digital Darwinism” – structures that resist digital transformation may disappear in the face of companies that are more adapted and oriented towards this new technological reality, which will solidify them in a competitive environment.

The Organization for Economic Cooperation and Development (OECD, 2018) has launched a new global project – “Going Digital: Making the Transformation Work for Growth and Well-being” – which aims to help policymakers better understand the digital transformation that is taking place and create a policy environment that allows their economies and societies to thrive in an increasingly digital world.

Over time, companies have invested and allocated resources to technology in order to innovate products and services that they offer to an increasingly demanding society.

Today, we are witnessing a convergence and synergy of disruptive technologies known by the acronym DARQ: Distributed Ledger Technology (DLT), AI, Extended Reality, and Quantum Computing. These technologies are already defining the future of society individually, but together they provide a synergy model, known as the DARQ Synergy Model, which incorporates quantum optimization algorithms, resulting in the resolution of complex combinatorial problems in a universe of data, facilitating the presentation of optimal integration strategies for a given sector (Hamiid et al., 2025).

The challenges that arise include the lack of a change management strategy in organizations, talent acquisition and retention, monitoring the continuous evolution of customer needs, internal resistance to change, lack of cybersecurity, and budget constraints (PECB, 2022).

The existing literature on DT in community pharmacies is limited, with many studies focusing on hospitals. Another point to note is the lack of comparative studies between community pharmacies with different degrees of digital maturity and their impact on internal dynamics and returns for both the pharmacy and for patients.

Pharmacies are healthcare facilities whose mission is to promote health, prevent disease, and care for the well-being of users, with underlying values of professional ethics, transparency, and encouraging literacy about the use of medication. Some pharmacies are not just dispensaries for medication and the assessment of certain biological parameters, but have built a modular, layered architecture where they carry out other

activities such as screening, support for other organizations, such as nursing homes, and provide public health guidance and primary care for the community. In a restricted, regulated, and highly competitive market, we are now seeing an expansion of services, such as nutrition and dietetics and sports nutrition services.

Community pharmacies in Portugal have made significant advances in digital technology over time, continuing to evolve alongside new technologies and digital practices. An example of this process of digital transformation is the first steps taken toward robotization.

For Baines et al. (2020), the pharmaceutical sector intrinsic to community pharmacies cannot remain stuck in traditional, linear thinking, assuming that the future will be an extension of the past. If it takes this position, the Industrial Revolution 4.0 could be more of a threat than an opportunity: “If the new game is understood, pharmacists may become the playmaster of tomorrow” (p. 1281).

In this sense, the main objective of this article is to analyse the impact of digital transformation on general management in community pharmacies, assessing how digital technologies influence processes in customer service, improvement of internal processes, and continuous adaptation to digital evolution, based on the perceptions of technical directors and/or pharmacy owners and a group of professionals with different academic backgrounds who work in different technology companies that collaborate with the community pharmacy channel.

The conceptual model applied was the Quintuple Helix, which, according to Carayannis & Campbell (2010), is an analytical framework in which knowledge and innovation are related to five distinct interconnected dimensions that drive innovation and development in a society.

It is an interdisciplinary analysis model that addresses the resolution of transdisciplinary issues in the context of the socio-ecological transition of common interests. Thus, the Quintuple Helix supports knowledge and innovation, creating synergies between the various dimensions, promoting integrated collaboration in a context of sustainability, with the aim of ensuring that structural transformations are guided by the common interest.

In this article, the five dimensions that impact digital transformation in general management in community pharmacies are:

- 1) Leadership and Organizational Culture;
- 2) Technology;
- 3) Strategic Management;
- 4) Customer Experience;
- 5) Sustainability.



Figure 1: Quintuple Helix Framework for Digital Transformation (DT) in Community Pharmacy (CP).

Thus, the model applied allows for an analysis of the interactive and multidimensional dynamics that occur in a specific and well-known environment such as the community pharmacy.

Although the Quintuple Helix (Carayannis & Campbell, 2010) serves as a theoretical basis for understanding collaborative innovation, this study proposes an applied evolution of the model, adapted to digital transformation in community

pharmacies. The integration of advanced technologies (e.g., AI, IoT, and Big Data Analytics) and the growing centrality of customer experience and sustainability justify a contextualized reinterpretation, reflecting the specific dynamics of the sector in Portugal.

The following table presents the translation of the canonical Five Forces model into the management dimensions used in this study, with examples of codes and indicators.

Table 1

Mapping of the Quintuple Helix to the adapted model.

Canonical Helix	Dimension (adapted in the dissertation)	Exemplary codes	KPIs/Indicators	Key Actors
Academia (Education/ Research)	Leadership and Organizational Culture	Training and Evaluation; Role of the Pharmacist; Technical Barriers	Training hours per person; Digital adoption rate (%); Certifications	Portuguese Pharmaceutical Society/ Universities; IT Suppliers; Technical Management
Industry (Companies/ Supply)	Technology	Technical Support; Financial Incentives; Interinstitutional Collaboration; Innovation; Cybersecurity; Logistics	Stockouts (%); Dispensing errors (ppm); Inventory time; Profit margin; Lead time	Wholesalers; ERP (Enterprise Resource Planning)/Hardware Suppliers; Pharmacy Management

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Table 1 (continued)

Canonical Helix	Dimension (adapted in the dissertation)	Exemplary codes	KPIs/Indicators	Key Actors
Government (Regulation/ Policies)	Strategic Management	Competition; Regulatory Compliance; GDPR; Total Technology cost (CAPEX+OPEX); Service Quality; Internal Pharmacy Data; ERP (Enterprise Resource Planning)	Privacy incidents (n); Recurrence rates; Compliance audits (%); Total cost of ownership TCO; Response time to GDPR requests	DPO (Data Protection Officer); Regulatory Authority; Superintendent Pharmacist
Civil Society (Customers/ Community)	Customer Experience	Results for the customer; Difficulties with Digital Technology; Communication; Trust in Technology; Loyalty	NPS (Net Promoter Score); Waiting time; Therapeutic adherence (%); Retention/Visits; Use of digital channels	Customers; Pharmacy staff; Community partners
Environment Sustainability/ESG	Sustainability	Resource optimization; Paper Reduction; Triple Bottom Line	kWh/m ² ; € energy/revenue; Printed paper; ESG Reputation; Estimated emissions (tCO ₂ e)	Facilities manager; Energy supplier; Community

1.1. Study Propositions (Derived From the model)

Based on the literature review, the adapted Five-Pillar model, and subsequent data analysis in MAXQDA, it is possible to identify empirical evidence that is or is not supported by the propositions formulated. Thus, the following guiding propositions for qualitative analysis are proposed:

- P1. Integrated ERP (Enterprise Resource Planning) and cycle counting reduce stockouts and dispensing errors, improving service quality.
- P2. Interoperability with wholesalers using EDI (Electronic Data Interchange) and demand forecasting increases efficiency and reduces tied-up capital.
- P3. Interinstitutional interoperability and customer data sharing improve service quality.
- P4. GDPR and basic cybersecurity controls (MFA – Multi-Factor Authentication, backups, EDR – Endpoint Detection and Response) strengthen digital trust and the adoption of online services.
- P5. Continuous training and leadership positively moderate the effect of technologies on operational efficiency.
- P6. Technological obsolescence contributes to decreased operational efficiency and negatively impacts service quality.

- P7. Digital channels contribute to service expansion and increased customer loyalty and lifetime value (LTV).
- P8. Operational dashboards coupled with AI and Big Data Analytics technology contribute to faster decisions and lower operating costs.
- P9. Financing strategy contributes to accelerating the digital roadmap and reduces TCO (Total Cost of Ownership).
- P10. Paperless and energy efficiency contribute to reducing OPEX and increase ESG (Environmental, Social, and Governance) perception.

2. Methodology

Methodology is a vital component, as it defines how the research problem is addressed and how data were collected and analysed for subsequent interpretation of the results. To contribute to a solution, research needs to combine theory with applied methodology, transforming itself into a research design tailored to a specific problem (Jonker & Pennink, 2010).

The choice of a qualitative methodology was based on the possibility of obtaining different perspectives from the interviewees, greater flexibility and openness in the study of the data, in order to discover patterns and trends within a specific

study framework (Miles & Huberman, 1994).

According Jonker & Pennink (2010), “*A single perception of reality does not exist. There is no explicit condition or situation that everyone interprets as universal reality*” (p.3).

According to Miles & Huberman (1994), qualitative data is characterized by relevant informational density and a holistic view, demonstrating strong potential for producing theoretical and practical insights that guide the understanding of a complex phenomenon.

This article takes an exploratory approach, given the emerging nature of digital transformation in community pharmacy.

As mentioned above, the methodology applied is qualitative, using individual semi-structured interviews based on a previously prepared script.

The sample will be non-probabilistic for convenience, targeting two independent groups: technical directors and/or pharmaceutical owners whose designated name is Farma, and another group named Techfarma, composed of professionals with different academic backgrounds, but who have in common the fact that they work in different technology companies that contribute to the community pharmacy channel.

Semi-structured interviews are designed to ensure relevant insights into digital transformation, specifically in community pharmacies.

2.1. Qualitative Sample

With regard to the composition of the sample, an equitable distribution was considered, with each group consisting of four members. The choice of participants was based on their level of knowledge and experience on the subject under study.

Why were two different groups formed?

The reason for forming two independent groups was to obtain a comprehensive and multidimensional view, with different understandings of the topic under study.

The Farma group has theoretical and practical knowledge of a professional reality, as they have daily contact with the community pharmacy context and have mastered its structural dynamics.

The Techfarma group has a vision that extends beyond community pharmacies, yet it serves as a bridge for building a new reality for community pharmacies, assisting in technological aspects with strategic contributions and know-how that play an indispensable role in understanding the changes arising from an ever-changing world.

2.2. Illustrative Characterization of the Sample

Table 2

Sample Characterization.

	Interview	Profession	Position	Date	Mode of Communication
Farma Group	A	Pharmacist	Owner and TD	19/03/2025	Online
	B	Pharmacist	Owner	20/03/2025	Online
	C	Pharmacist	TD	27/05/2025	In person
	D	Pharmacist	TD	09/07/2025	Online
Techfarma Group	E	Marketing Executive	Retail & Consumer Health Business Unit Director	28/05/2025	By phone
	F	Engineer	IT Consultant	28/05/2025	Online
	G	Manager	Sales Coordinator	06/06/2025	Online
	H	Pharmacist	Sales Coordinator	09/07/2025	Online

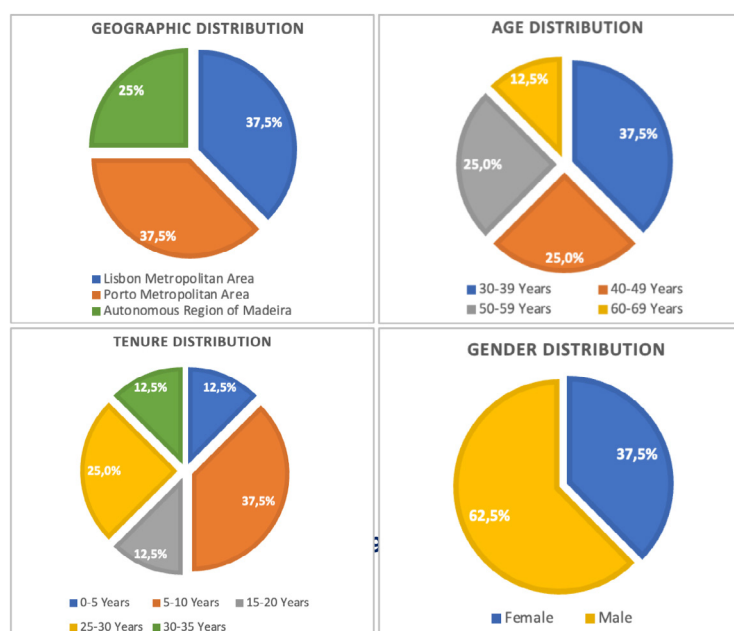


Figure 2: Sample Geographic, Demographic and Tenure Distribution.

2.3. Data Collection and Analysis

The interviews were recorded with the consent of the participants using a specific app for this purpose.

Most of the interviews were conducted via the Microsoft Teams platform and transcribed manually, clean verbatim, into a Microsoft Word document, ensuring the consistency and clarity of the data provided by the interviewees.

The interviews were analysed using MAXQDA 2024 software with a thematic analysis coding process. According to Braun & Clarke (2013), it is essential for researchers who use a theory-driven thematic approach to construct a coding system based on a theoretical framework in the literature.

The analysis reached a point of saturation, as no further themes were developed and the coding system reached a point of stabilization.

3. Results

In this regard, the respective codes and subcodes were determined for each dimension, in line with the respondents' answers to the research questions. Thus, the following coding was developed with the relative distribution of the segments coded by the respective code, revealing the percentage of mentions by each participant for the total number of times each theme was described, as shown in the following table:

Table 3
Participants' Percentage Coding Matrix.

List of Codes	A	B	C	D	E	F	G	H
Technological Dimension								
Technical Support	26,7%	60,0%			13,3%			
Inertia in Hardware and Software Systems		30,8%	23,1%			23,1%	7,7%	15,4%
Financial Incentive	85,7%				14,3%			
Interinstitutional Collaboration	37,9%	20,7%	13,8%	13,8%	3,4%		6,9%	3,4%
Innovation	13,6%	21,1%	12,9%	18,4%	6,1%	7,5%	6,8%	13,6%
Cybersecurity	61,5%		15,4%					23,1%
Supply chain logistics	25,0%	18,8%	18,8%	12,5%	12,5%	6,3%		6,3%
Leadership and Organizational Culture Dimension								

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Table 3 (continued)

Pharmacist's Role	35,1%	19,3%	7,0%	21,1%		1,8%	12,3%	3,5%
Concerns, Resistance, and Technical Barriers	7,5%	7,5%	27,5%	10,0%	7,5%	5,0%	15,0%	20,0%
Training and Assessment	25,0%	33,3%	5,6%		2,8%	11,1%	8,3%	13,9%
Strategy	16,0%	21,8%	14,3%	12,6%	10,1%	7,6%	1,7%	16,0%
▼ Strategic Management Dimension								
▼ Digital Ecosystem	40,0%	40,0%			20,0%			
Wholesaler Interaction			33,3%	33,3%	33,3%			
Customer Interaction	23,1%	30,8%	19,2%	15,4%	3,8%	1,9%		5,8%
Competition	8,7%	4,3%	8,7%	30,4%	30,4%	17,4%		
Business Strategy	10,9%	8,7%	8,7%	30,4%	15,2%	10,9%	6,5%	8,7%
▼ Regulatory Compliance	22,2%	16,7%		22,2%	11,1%		27,8%	
Customer Data – GDPR	30,8%	33,3%	7,7%	5,1%	10,3%	2,6%		10,3%
Total Technology Cost (CAPEX+OPEX)	6,7%	20,0%	20,0%	20,0%				33,3%
Service Quality	38,1%	28,6%	7,6%	5,7%	2,9%	5,7%	7,6%	3,8%
Internal Pharmacy Data	22,2%		11,1%		11,1%	11,1%	11,1%	33,3%
▼ Operational Efficiency	10,9%	17,4%	14,1%	17,4%	9,8%	9,8%	14,1%	6,5%
Financial Management	11,8%	17,6%	23,5%		5,9%	11,8%	17,6%	11,8%
Human Resources Management	3,6%	21,4%		3,6%	35,7%	3,6%	7,1%	25,0%
Inventory Management	12,0%	28,0%	8,0%	6,0%	2,0%	8,0%	30,0%	6,0%
Customer Management	21,1%	31,6%	10,5%	10,5%			5,3%	21,1%
ERP		57,9%	5,3%		26,3%	10,5%		
▼ Customer Experience Dimension								
Patient Outcomes	42,9%	24,3%	14,3%	2,9%	4,3%	4,3%	1,4%	5,7%
Difficulties with Digital Technologies	71,4%			28,6%				
Communication	10,7%	14,3%	17,9%	21,4%	7,1%	10,7%	3,6%	14,3%
Trust in Technology		18,2%	27,3%	9,1%	9,1%	9,1%	9,1%	18,2%
Loyalty	8,8%	29,4%	20,6%	20,6%	8,8%	2,9%	5,9%	2,9%
▼ Sustainability Dimension								
▼ Resource Optimization	13,0%	39,1%	21,7%		4,3%	8,7%	4,3%	8,7%
Stock Management	12,5%	31,3%	18,8%		6,3%		25,0%	6,3%
Paperless	9,1%	36,4%	9,1%		18,2%			27,3%
Triple Bottom Line	6,7%	6,7%	26,7%	13,3%	20,0%	13,3%		13,3%

3.1. Proposition P1 — Integrated ERP and Cyclical Counting Reduce Stockouts and Dispensing Errors, Improving Service Quality

Inventory management is a priority in balancing sufficient stock levels with meeting user needs.

The more mature the ERP and inventory management automation, the lower the rate of stockouts and dispensing errors, resulting in greater management efficiency.

- Dimensions: Technology and Strategic Management.
- Coding terms: Technical Support, Innovation, Oper-

ational Efficiency in Stock Management, Operational Efficiency in ERP, and Service Quality.

- Empirical Evidence in the Pharma Group: “(...) ERP suppliers must challenge themselves to go much further and provide much more support to community pharmacies.”; “They are largely responsible for the technological transformation of pharmacies, from a management and service perspective”; “Today we see our ERP systems stagnating. We are seeing some progress, some insights, some improvements, but we have to take the leap, and now is the time.”; (participant B, lines 86, 87, 95).

- Empirical evidence in the Techfarma group: “(...) it is expected that software houses will continue to work to try to bring more innovation, because it is the only way they have to grow their business.” (participant E, line 196).
- Summary of the pattern: The comments made by interviewee B reveal a need for innovation in ERP software, which is an essential tool for the operational management of pharmacies. Interviewee E’s position is dominated by the idea of building a path of cooperation and technological evolution.
- Assessment: Sustained.
- Discussion: The integrated ERP software system is a tool that promotes efficiency and quality. It is considered a structural element of the business model and allows valuable insights into the internal dynamics of the CP, serving as a starting point for strategic decisions.

Thus, it follows a guideline of technology as a driver of DT, which is in line with the author Kraus et al. (2021), since one of the authors’ positions is to place technology at the core of achieving competitive advantage.

- Practical implications: The results of this study demonstrate the importance of updating and improving the ERP management component. We suggest implementing a forecasting system associated with machine learning algorithms, IoT sensors for real-time stock monitoring, and decision dashboards.

Another point is the rules in cyclical inventory, where accounting can be performed periodically (monthly) instead of conducting an annual inventory.

- KPIs: Percentage of stockouts; check the quantity in terms of differences between the actual inventory and the ERP record (stock deviation) normalized to ppm; assess customer satisfaction and the recommendation metric for the pharmacy using NPS (Net Promoter Score).
- Notes: Conditions, data quality, integration with purchasing.

3.2. Proposition P2 — Interoperability with Wholesalers Using EDI and Demand Forecasts Increases Efficiency and Reduces Tied-Up Capital

Interoperability with wholesalers is vital to the functioning of any business structure.

With regard to CP, technologies such as EDI, which enable digital data transmission between these two entities, are essential for internal dynamics. The pharmacy’s goal is to maintain a demand forecast that reduces capital in stock and increases the level of efficiency throughout the service, especially with clean ERP data.

- Dimension: Technology and Strategic Management.
- Coding: Logistics, Digital Ecosystem in Wholesale Interaction, Commercial Strategy, and Operational Efficiency Stock Management.

- Empirical evidence in the Pharma group: “With regard to the internal functioning of the pharmacy, there is greater connection and communication (...) with distributors, who, in the context of medicine availability management, aim to ensure that the necessary medicines are accessible to everyone in the community” (participant D, line 46).
- Empirical evidence in the Techfarma group: “Wholesalers already have integrated stocks, stock management is fully done” (participant E, line 68).
- Summary of the pattern: We can see from interviewee D that today, in the technological field, the interaction between CP and wholesalers is well established and assured in the sense that it always provides an efficient response to the community in guaranteeing regular and continuous access to medicines.

Regarding interviewee E, the high technological level with which suppliers operate in the logistics chain is evident, where there is structured and complex automation.

- Assessment: Sustained.
- Discussion: There is a complex dynamic in relation to this proposition, since in CP there is, on the one hand, the issue of CRM and, on the other hand, the issue of inventory. Therefore, cooperation between these two entities is important to meet customer needs. In this sense, we follow the line of literature by Matt et al. (2015), noting that DT is intrinsically connected in strategic terms with digital, with the supply chain, with processes, and with organizational structure.
- Practical implications: The results of this study demonstrate the importance of continuous and efficient connectivity with wholesalers, with the aim of optimizing stock parameters and continuously responding to customer needs.
- KPIs: Direct indicator that assesses supply chain efficiency – Fill rate (%); Average values of days of merchandise stock; monitor capital in stock as an indicator of the financial component.
- Notes: Dependence on wholesalers, seasonality.

3.3. Proposition P3 — Interinstitutional Interoperability and Customer Data Sharing Improve Service Quality

Interinstitutional interoperability is imperative today for a healthcare entity such as CP. Through EDI technologies following international HL7 (Health Level 7) standards for the transfer of clinical data and with the implementation of FHIR (Fast Healthcare Interoperability Resources), it is possible to establish an efficient, secure interoperability model that meets DT in healthcare.

In fact, the customer must be the focus of the system at all stages, and by placing the customer at the centre, CP must have access to the customer’s clinical data, which is important for the pharmacist’s performance.

- Dimensions: Technology, Leadership and Organizational Culture, Strategic Management, and Customer Experience.
- Coding terms: Interinstitutional Collaboration, Cybersecurity, Role of the Pharmacist, Regulatory Compliance, GDPR Data, Service Quality, and Results for the User.
- Empirical Evidence in the Pharma group: “(...) in the future, it is crucial that there be interoperability between the pharmacy system and what happens in health centres and local health units (ULS);” “(...) increasing integration of community pharmacists and pharmacies into the ecosystem and health systems” (participant A, line 115; 287).
- Empirical evidence in the Techfarma group: “(...) respond to the call from the national health service to complement more services and connect with health centres and hospitals, assisting these large-scale and complex structures” (participant G, line 169).
- Summary of the pattern: Through the discourse of interviewee A, the need for this cooperation for the benefit of the user is very clear. Similarly, participant G states that it will be a structural step towards a synergistic strategy for promoting user health.
- Assessment: Sustained.
- Discussion: Interoperability between the CP and the various national health structures would have to be based on the GDPR and would involve continuous monitoring of users through a health data platform. This would ensure a holistic view of the patient, improving the quality of the service.
- Practical implications: The results of this study reveal the importance of interoperability between healthcare systems and the CP. In fact, there is the issue of health data, which is one of the most powerful resources, and there must be clear legislation to protect user privacy, always in accordance with GDPR compliance.

The data is at the service of the pharmacy for the user, and the entire internal structure must understand and establish a commitment to accountability in the treatment of such data based on criteria of seriousness and honesty.

- KPIs: Accounting for incidents (n) of failures in shared services (SPMS - Shared Services of the Ministry of Health) and GDPR response time.
- Notes: Dependence on systems.

3.4. Proposition P4 — GDPR and Basic Cybersecurity Controls (MFA, Backups, EDR) Strengthen Digital Trust and the Adoption of Online Services

Healthcare data must comply with the GDPR, given that data is seen as a strategic asset and, as such, it is well known that a huge amount of data is produced on a daily basis in

that a huge amount of data is produced on a daily basis in pharmacies, whether in terms of CRM data or management data relating to the pharmacy itself as an organization. In this regard, basic cybersecurity is vital, as health data must be protected against unauthorized access or negligent use. There is a need to use MFA (Multi-Factor Authentication) security controls, backup systems, and technologies focused on protecting all network endpoints (EDR – Endpoint Detection and Response), increasing confidence in technologies and the use of a reinforced CRM.

- Dimensions: Technology, Leadership and Organizational Culture, Strategic Management, and Customer Experience.
- Coding terms: Cybersecurity, Role of the Pharmacist, Regulatory Compliance, GDPR Customer Data, Service Quality, and Trust in Technology.
- Empirical evidence in the Pharma group: “(...) data protection is a sensitive issue and obviously there has to be a guarantee of data protection and obviously there has to be a guarantee that the current and future mechanisms will provide security for all stakeholders” (participant C, line 158).
- Empirical Evidence in the Techfarma group: “(...) data security, whether we like it or not, the results that a pharmacy generates are enormous and are sensitive data, they are health data. I think that there is still not enough attention being paid to the data we are using and the potential for using this data” (participant H, line 80).
- Summary of the pattern: With regard to participant C, there is a concern about data and compliance with the GDPR, specifically data security. Regarding participant H, the critical issue of cybersecurity and the enormous amount of data that pharmacies generate as entities is noteworthy, as it is a strategic resource and seen as economic value.
- Assessment: Sustained.
- Discussion: At this point, it can be said that data is now a dominant resource available to CP. Within this issue, there is the legislative question, which must be transparent and guarantee privacy and personal data protection, leaving no doubt about future situations regarding who really owns the data: The customer? The CP? The State? Compliance with GDPR standards must be mandatory, and today pharmacies have a detailed and very robust database that can be classified as one of the fundamental resources for digital transformation in community pharmacies.

Regarding the role of the pharmacist, a multidisciplinary professional, they often have to find solutions to more complex problems, where access to data contributes to better performance of their work.

In relation to the literature, we can follow the guideline of the author Verhoef et al. (2021), when he states that digital technology and customer behaviour are external drivers of digital transformation and, in this specific case, the customer has great power, the power of data, and if they do not want to make it available, no one can use it.

- **Practical implications:** There should be a consent policy and phishing training practices for CP employees to recognize cyberattacks, always following procedures based on backup plans and information management tests.
- **KPIs:** Number of incidents (n), GDPR response time, recurrence rates, and percentage of signed data consents.
- **Notes:** Risk perception vs. cost.

3.5. Proposition P5 — Continuous Training and Leadership Positively Moderate the Effect of Technologies on Operational Efficiency

One of the key factors for a team's success is training and empowering them to work with and integrate technologies into their daily routine. There needs to be a spirit that promotes this learning and encourages digital follow-up.

- **Dimensions:** Leadership and Organizational Culture and Strategic Management.
- **Coding terms:** Role of the Pharmacist, Training and Evaluation, Strategy, and Operational Efficiency.
- **Empirical Evidence in the Pharma group:** "Training is crucial, it is the basis of everything, involvement, bringing people to another level, and this is one of the points I emphasize the most, the need to change the leader's mindset" (participant B, line 226).
- **Empirical evidence in the Techfarma group:** "(...) often having the opportunity to experiment and not just talk about it allows people to test it, to feel how this new technology can change the paradigm in the workplace" (participant F, line 81).
- **Summary of the pattern:** With regard to continuing education, interviewee B has a comprehensive view, in that pharmacists should have a continuous and broad line of instruction that strengthens a continuing education health team.

Regarding interviewee F, there is a need for people to get involved in the subjects and even more, so when it comes to technology practice. In fact, the opportunity to do, to touch, to relate to technology can change and add new skills to CP.

These statements are in line with interdisciplinary evidence that emotional well-being and cognitive openness enhance the generation of ideas and the adoption of digital practices in services, reinforcing the role of leadership in creating enabling environments (W.O.M.B. model) (de Almeida Leite, Audretsch & Leite, 2025).

- **Assessment:** Sustained.
- **Discussion:** Both groups agree that training and lead-

ership that promotes innovation and the acquisition of new knowledge are better prepared to face new challenges. In an environment such as CP, having new tools means greater freedom to work towards personalizing care, and a significant technological base allows more time to spend with the customer.

Learning and using technological resources frees pharmacists from operational tasks with less added value, allowing them to perform other services focused on the user. Consequently, it is necessary to identify skills gaps and invest in structural reskilling and upskilling plans, resulting in greater efficiency while ensuring the success of DT.

This line of thinking is in line with Martínez-Morá et al. (2021), who state that companies must invest in knowledge to bridge the digital transformation gap.

- **Practical implications:** the results demonstrate the need to invest in training and preparing teams in CP.
- **KPIs:** Number of training hours for each employee, digital adoption (%), service time, and costs/revenue.
- **Notes:** Team turnover as a negative moderator.

3.6. Proposition P6 — Technological Obsolescence Contributes to Decreased Operational Efficiency and Negatively Impacts Service Quality

In any corporate environment, the speed and correct operational functioning of the entire technological system is essential, in this case for the internal dynamics of CP. The fact that there are constant failures, insufficient performance, and slow response times on the part of the technological infrastructure has a negative impact on service quality.

- **Dimensions:** Technology and Strategic Management.
- **Coding terms:** Hardware and Software Inertia and Service Quality.
- **Empirical Evidence in the Pharma group:** "(...) our computer system has recurring updates, but over time the software becomes increasingly heavy, slowing down the machines" (participant C, line 139).
- **Empirical evidence in the Techfarma group:** "(...) many community pharmacies use older hardware and software systems and have many difficulties integrating with the latest technologies" (participant F, line 64).
- **Summary of the pattern:** Regarding interviewee C, there is a clear concern that the technology used in pharmacies is not up to date and does not meet the minimum requirements necessary to absorb rapid technological development. Regarding interviewee F, he points out that many pharmacies have difficulty keeping up with this progression, leading to barriers when it comes to moving on to the next step.
- **Assessment:** Sustained.
- **Discussion:** Sometimes, the pharmacy's technological infrastructure is not updated, either for financial reasons

or from a leadership perspective. There is no need to make a state-of-the-art investment, but keeping up with technological developments is imperative for innovation and growth in a constantly evolving market. This proposition is in line with Kraus et al. (2021), who argue that technology can be considered one of the key drivers for achieving DT.

- **Practical implications:** It is essential to carry out regular updates, making all internal processes more automated and increasing employee performance, which is essential for the success of any digital transformation.
- **KPIs:** Average age of technology park, process failure rate, and productivity.
- **Notes:** Circular Economy.

3.7. Proposition P7 — Digital Channels Contribute to the Expansion of Services and to Increased Customer Loyalty and Lifetime Value (LTV)

Digital channels are a vehicle for symbiotic interaction with customers, using flexibility that allows us to respond to each customer's needs at any time.

- **Dimensions:** Technology, Strategic Management, and Customer Experience.
- **Coding terms:** Innovation, Digital Ecosystem, Customer Interaction, Competition, Commercial Strategy, User Outcomes, Communication, and Loyalty.
- **Empirical Evidence in the Pharma group:** “In the case of online shopping and online appointments, these are services that also build loyalty. For example, at the pharmacy, we have an online calendar for scheduling appointments (...)” (participant C, line 220); “I don't think digital channels build customer loyalty. Social media channels and digital channels build loyalty to price. If I have a well-oiled machine for pricing, the digital channel will build loyalty very well” (participant D, line 213).
- **Empirical evidence from the Techfarma group:** “(...) nowadays, consumers are more easily influenced by price-driven or other factors, resulting in lower loyalty to the pharmacy channel.” (participant E, line 177); “Another area is telemedicine services, online consultations, where it is possible to monitor the population more closely and even include those who, for some reason, are unable to travel to the pharmacy.”; “With the new channels, it is possible to segment, reach new customers in a personalized way, facilitating loyalty.” (participant H, line 21; 149).
- **Summary of the pattern:** Regarding the association between service expansion and loyalty, interviewees C and H mention that the introduction of services through online channels has a loyalty-building character, while interviewees D and E agree that digital channels are positive for customers, but there is a lower loyalty profile to the digital pharmacy channel, largely due to price-driven

phenomena. In line with the principle of data value chains, the combination of internal (ERP/POS) and external (wholesalers, booking platforms, public systems) data increases the usefulness for decision-making and the performance of digital channels, underlining the importance of interoperability and data governance (Sepúlveda, 2023).

- **Assessment:** Partially supported.
- **Discussion:** Nowadays, it is important for community pharmacies to provide an efficient and personalized experience for their customers and to fulfill their needs, both in terms of service provision and health literacy. Currently, there are pharmacies that offer a range of consultations and in the future may introduce digital pharmaceutical consultations. In this way, community pharmacies use a resource to strengthen their care role, providing more differentiated, efficient, personalized, and accessible services. There is digital therapy management with remote health monitoring. As in the literature, authors Verhoef et al. (2021) state that DT involves digital resources and will ultimately lead to continuous digital growth that is integral to corporate culture.

The point of contention is that digital channels amplify competition, modifying the variables that eventually lead to loyalty. According to the literature, it appears that, for the most part, digital channels with a price-driven strategy lead to a low LTV in the long term (Dara et al., 2025).

- **Practical implications:** Customer experience is paramount to loyalty, and digital presence is a tool that helps reach an increasingly connected and informed community. However, special attention must be paid to price-driven competition, which can lead to market distortions and whose trend can lead to unsustainable situations in the long term.
- **KPIs:** Frequency of use of digital channels, online conversion rate, NPS, number and volume of online channel sales, average response time on the digital channel, percentage of users of online services, and service completion rate.
- **Notes:** Baby Boomer generation.

3.8. Proposition P8 — Operational Dashboards Coupled with AI and Big Data Analytics Technology Contribute to Faster Decisions and Lower Operating Costs

Data is essential for decision-making. And in the context of CP, it is important to have real-time monitoring tracking the performance of the pharmacy as a business. Within this reality, visible and regularly reviewed KPIs can be applied to guide waste reduction and accelerate the response to complex problems.

- **Dimensions:** Technology, Strategic Management, Sustainability.
- **Coding terms:** Innovation, Commercial Strategy, Ser-

vice Quality, Internal Pharmacy Data, Operational Efficiency, and Resource Optimization.

- Empirical Evidence in the Farma group: “(...) artificial intelligence, machine learning allowing predictive analysis and optimization of stocks and processes (...) tremendous added value from the point of view of waste control”; “From a financial management point of view, also with predictive analysis (...) sources of information that allow us to predict market developments, develop business plans, understand how the economy is evolving, but if we have all this information integrated and can be analysed using technology, it will certainly make us pharmacists better managers, at least we will be able to better predict the evolution of our company.” (participant B, line 125; 180).
- Empirical evidence in the Techfarma group: “Support from highly sophisticated digital systems opens the door to an almost unlimited source of information”; “(...) with the support of software systems and digital system licenses, we are able to search for the information we need at any given moment” (participant F, lines 92; 96).
- Summary of the pattern: Interviewee B emphasizes that these new technological tools are beneficial for the management of the pharmacy itself, which brings advantages for all parties involved. Interviewee F praises these technological tools as a strong aid in decision-making by managers, since they concentrate and analyse all the necessary information in real time. These qualitative findings are in line with national quantitative evidence: high-quality information systems improve the quality of information (financial and non-financial), increasing its usefulness for decision-making and, thereby, operational/customer performance. (See, for example, SEM models in studies with Portuguese companies). (Monteiro et al., 2022; Monteiro et al., 2024).
- Assessment: Sustained.
- Discussion: Technology is one of the drivers of DT in CP, and when automation processes are introduced, decision-making processes are streamlined, leading to a reduction in operating costs.

According to Pousttchi et al. (2019), technological optimization generates added value, leading to cost reductions and improved service delivery.

- Practical implications: Promoting innovation in CP provides a competitive advantage in the market, even if only temporary. These tools lead to the optimization of the entire organizational structure.
- KPIs: Cost/Revenue, Decision Lead Time, Productivity.
- Notes: Data quality; RACI (Responsible, Accountable, Consulted, Informed) matrix model.

3.9. Proposition P9 — Financing Strategy Contributes to Accelerating the Digital Roadmap and Reduces TCO (Total Cost of Ownership)

A financing strategy aims to modernize the entire pharmacy sector, creating a benchmark that contributes to better service quality and a much more efficient operating system, reducing CAPEX/OPEX barriers and accelerating the adoption of more modern ERP, EDI, and internal automation systems. In this regard, it is crucial to use strategic tools such as a roadmap to align objectives and follow a plan that attracts investment in order to raise CP in Portugal to a higher level.

- Dimensions: Technology and Strategic Management.
- Coding terms: Financial Incentives, Innovation, Total Technology Cost (CAPEX+OPEX), and Service Quality.
- Empirical Evidence in the Pharma group: “(...) if there are incentives and financial support for the digitization of companies and technological modernization, it will be much easier for all pharmacies in the country to adopt it.” (participant A, line 172).
- Empirical evidence in the Techfarma group: “(...) ongoing process with incentives from the government and Portuguese National Association of Pharmacies (ANF)” (participant E, line 192).
- Summary of the pattern: With regard to interviewee A, there is a position of technological uniformity for all pharmacies and pharmacists in terms of investing in DT, but for this to be possible, financial incentives are needed to enable pharmacies to move in this direction. Interviewee E emphasizes two entities that can help in this DT process, reaffirming the importance of financial support in this process.
- Assessment: Sustained.
- Discussion: Financing is a catalyst for the growth of a culture of innovation. It is essential to promote accessible financial incentives to support technological transition, for example, in the fiscal field for the acquisition of technology.
- Practical implications: In a funding framework with lines of support for innovation, it is necessary to study partnerships that are eligible for this purpose. Always assessing the implications of these changes in the CP paradigm, with dossiers ready, budgets, and benefits that these changes may bring to this area.
- KPIs: euros (€) raised; Speed of implementation; TCO.
- Notes: Risk of dependence on incentives.

3.10. Proposition P10 — Paperless and Energy Efficiency Contribute to Reducing OPEX and Increase ESG (Environmental, Social, and Governance) Perception

Paper reduction and energy optimization have short paybacks and reinforce sustainability by creating long-term value for stakeholders.

- **Dimensions:** Sustainability.
- **Coding terms:** Resource Optimization, Paper Reduction, and Triple Bottom Line.
- **Empirical Evidence in the Pharma group:** “With regard to the optimization of material energy resources through digitization and paper reduction, we believe that we are already moving in that direction.” (participant B, line 458).
- **Empirical Evidence in the Techfarma group:** “It promotes stock resolution, which is already one of the main sustainability practices, avoiding excessively high stocks and reducing the overall impact on their cycle.” (participant G, line 183).
- **Summary of the pattern:** Regarding interviewee B, it can be concluded that we are on the right track, although there is room for improvement, since we have not yet achieved full sustainability. Interviewee G’s position encompasses stock management in the dimension of sustainability, since greater efficiency in this field leads to greater optimization of resources at all levels.
- **Assessment:** Sustained.
- **Discussion:** In the context of sustainability, it can be said that the integration of technologies that support the viability of DT contributes significantly to circular economy practices. One example is inventory management, where there are no longer pharmacies with excess stock and others with stock shortages, i.e., there is a more equitable distribution in line with users’ needs. In energy-intensive services, the literature shows that good efficiency and monitoring practices reduce consumption and operating costs, reinforcing the ESG perception — which justifies kWh/m² and € energy/revenue as environmental KPIs also in community pharmacies, by sector analogy (Mota, Leite & Ghasemi, 2024). In addition, transparency in “green” practices and staff training are emerging as vectors for tangible energy savings and reputation improvement, parallels that apply to community pharmacies (Mota, Leite & Ghasemi, 2024).

In terms of paper reduction, this is imperative both in logistics and in the implementation of the EMP system (electronic medical prescription).

However, the use of technological resources such as AI also poses challenges, particularly in terms of energy consumption.

The way forward will be to ensure greater sustainability and a reconfiguration towards user-centricity.

- **Practical implications:** The importance of no longer working with paper prescriptions and the fact that the entire process is now electronic.
- **KPIs:** Energy consumption per unit produced (kWh/m²), euros (€) energy/prescription, (n) pages printed, and ESG rating.

- **Notes:** Minimal investments and team habits.

4. Discussion

The literature on the concept of DT is vast, as it transcends a simple definition. In fact, DT is multidimensional and brings a new paradigm to CP, whose dynamics are complex and challenging with pharmaceutical and non-pharmaceutical players.

This qualitative study, based on semi-structured interviews with pharmaceutical and technology professionals (two groups), was analysed by thematic coding, generating operational propositions aligned with the five mapped dimensions.

In this sense, DT provides a redefinition of an entire business model, translating into efficiency, increased quality, and placing the user in a central position. It is a concept that involves several dimensions, including leadership and organizational culture, management, and technology, which, when strategically integrated, enhances pharmaceutical services, values the customer experience, and, in a business context, confers responsibility for sustainable development.

In the field of challenges in DT itself, whenever an organization undergoes structural changes, it is expected that there will be:

- a) Absence of a management strategy for organizational change, which must be initiated with the human component and not through technology;
- b) Lack of specialized skills;
- c) Continuous evolution of customer needs, with a view to meeting their expectations and requirements;
- d) Internal resistance to change on the part of teams;
- e) Concerns about digital security;
- f) Potentially high investments, which may lead to budget constraints.

Regarding the empirical findings summarized. (i) ERP maturity and cyclical counting generate fewer disruptions and less administrative time; (ii) GDPR and cybersecurity provide greater digital confidence and enable online services; (iii) dashboards/KPIs make decisions faster and improve resource allocation; (iv) paperless and energy efficiency lead to reduced OPEX and enhanced ESG perception; (v) financing/support accelerates the digital roadmap (with risks of dependency); (vi) leadership/culture are critical conditions for sustained adoption.

DT introduces challenging new work configurations; however, we must never forget that we are gregarious beings and this study shows that, in general, new technologies are here to support us and not to replace us. DT involves strategic decisions, models focused on agile processes and personalized experiences, resulting in structural efficiencies.

These results indicate clear causal chains: dashboards reduce information asymmetries (intervention), shorten decision time (mechanism), and improve operational indicators (result); paperless/energy efficiency means fewer consumables and lower kWh/m²; GDPR/cybersecurity reinforce user con-

fidence and the adoption of digital services.

In this context, there are several obstacles mentioned above, ranging from fears, resistance, and technical barriers to issues of regulatory compliance and cybersecurity. In fact, regulatory and ethical issues are important and decisive milestones in the protection of personal data in Europe; we look at other geographical areas of the planet where this issue is not so sensitive. We can conclude that we are on the right track, but we must be ready for a certain degree of flexibility so as not to block progress.

The solution lies in technically robust information security policies and government guidelines (Schilirò, 2022). Operationally, it is recommended to monitor five (5) core KPIs: % of breakdowns, average waiting time, pages printed/month, kWh/m², and € energy/revenue; define baselines and quarterly targets and integrate these indicators into management dashboards.

CP has the potential to become a broader ecosystem of services, starting with pharmacies and eventually reaching users' homes/workplaces, although for this to happen, it must be based on the following premises:

1. Excellence of teams, particularly in the role of the pharmacist;
2. Incorporating DT to speed up processes;
3. Considering data as a resource for optimizing patient care;
4. Financial and technical investment.

The main forces shaping the future of community pharmacy in Portugal will be technology, economics, regulation, and social values—thinking about preventing disease upstream.

With regard to the view of DT in CP, this study has some limitations that must be considered:

- a) The rapid changeability of technological and regulatory realities;
- b) In the Customer Experience dimension, there may be a bias in the perception of a sample with digital literacy, which does not represent the current general population of patients;
- c) Absence of comparative studies on technology in the pharmacy sector in Portugal;
- d) Intentional and non-probabilistic sample; inclusion criteria and evidence of saturation should be explained in the final version.

Future avenues should include converting propositions into testable hypotheses and evaluating them with before-and-after designs and time series in multiple pharmacies (e.g., impact of dashboards on % of stockouts/waiting time and paperless on OPEX/ESG).

Finally, study the role of the pharmacist, in terms of technological evolution, from a probabilistic perspective, perhaps not too far off, of living in a reality of pharmaceutical algorithms, where they do not have to be perfect, only better than human pharmacists.

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FROM PERSON-CENTERED TO PERSON-BASED CARE: IMPLICATIONS FOR ORGANIZATIONAL ETHICS AND INNOVATION

From person-centered to person-based care: Implications for organizational ethics and innovation

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ABSTRACT

The literature tells us that the concept of person-centered care is based particularly on humanistic psychology and participatory clinical practice, valuing autonomy, empathy, and individual experience. Person-based care seeks the ontological and moral roots of the very act of caring, insofar as the person is the foundation, meaning, and ultimate goal of all ethical and professional action. Historically, the concept of person-centered care emerged with Carl Rogers (1961) and was further developed in nursing by McCormack and McCance (2006, 2017). This model promotes the humanization of practice, recognizing the individual as an active participant in their own health process. However, despite its clinical value, this model can be limited to a methodological or relational approach, without questioning the nature of the human being who is being cared for. Person-based care, on the other hand, introduces an ethical and anthropological depth. It is not merely about placing the person at the center, but about recognizing that care finds its ethical, spiritual, and ontological foundation in the person. In this article, we seek to engage with several authors who address and develop the concepts of person-centered care and person-based care. This paper also explores the implications of person-based care for organizational contexts, particularly in healthcare management, innovation processes, and entrepreneurial ecosystems. By reframing care as an ethical and ontological foundation rather than a procedural model, the study contributes to discussions on value creation, leadership, and responsible innovation in contemporary organizations.

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This paper adopts a conceptual and hermeneutic approach, drawing on key philosophical and bioethical authors to critically analyse the evolution from person-centered to person-based care. In this sense, the present work does not aim to introduce conceptual novelty for its own sake, but rather to deepen and reinterpret existing frameworks through a philosophically grounded perspective. This position resonates with calls in organization theory to avoid “theoretical neophilia” and instead engage in reflective and historically informed theory development (Hassard, Cox, & Rowlinson, [2013](#)).

1. Origin of Person-Centered Care to Person-Based Care

1.1. Person-Centered Care

1.1.1. Humanist Origins - Carl Rogers

Carl Rogers (1902–1987), American psychologist, founder of the person-centered approach, was the first to use this expression initially in the field of psychotherapy, arguing that the therapist should focus on the person of the client, and not on the problem. The key ideas of his thought state: a) the person has within himself the potential to grow and to realize himself; b) the professional must adopt an empathetic, authentic and non-judgmental attitude; c) The therapeutic relationship is the space of healing.

From Rogers onwards, the expression “person-centered” was adapted to health and nursing, becoming a paradigm of humanized care.

1.1.2. Tom Kitwood (1937–1998)

Tom Kitwood is a British sociologist and psychologist and applied the concept to the care of people with dementia, introducing the term person-centered care in geriatrics. It argues that the essential thing is to preserve the identity and dignity of the person with dementia, recognizing him as a subject and not as a “patient”.

1.1.3. Person-Centered Care in Nursing - Kitwood, McCormack and McCance

As nurses and researchers, Kitwood, McCormack and McCance, structured the theoretical model of person-centered care in nursing and proposed the *Person-Centered Practice Framework*, one of the most influential models at the international level. Person-centered care emerges as an evolution of the biomedical model, which focuses predominantly on disease and symptoms, and to counter the disease-centered tendency, the authors propose an approach that integrates the biological, psychological, social and spiritual dimensions of the individual. The elements of the model include: a) practice based on values of respect, empathy and partnership; b) au-

thentic and reflective professional; c) Organizational context that supports humanization; c) the care resulting from a mutually significant relationship.

This is the most widely used framework in nursing and care management at an international level.

1.2. Person-Based Care

1.2.1. Paul Ricoeur - Ethics of Relationship and Responsibility: Phenomenological Basis of Person-Based Care.

Paul Ricoeur defines ethics as the “desire for a good life, with and for others, in just institutions.” Ethical care is born from interpersonal relationships, reciprocal responsibility and the recognition of otherness. This vision is at the basis of person-based care as a moral subject. In his work “*Soi-même comme un autre*” ([1990](#)), Ricoeur proposes an ethics centered on the idea that personal identity is built in the relationship with the other, through a continuous process of recognition and responsibility.

“To be a person is to be able to say ‘I’ in front of a ‘you.’” - Paul Ricoeur, [1990](#)

In the context of care, this means that care is a relational and ethical act, in which the caregiver recognizes the other as a dignified, free and vulnerable being, and not only as an object of care. The author develops the ethics of solicitude (*sollicitude*), understood as a moral response to the vulnerability of the other. Solicitude is more than compassion: it is an active recognition, which implies accepting, understanding and acting in favour of the other, respecting their dignity and autonomy.

“Solicitude is the reciprocity of esteem for oneself and esteem for the other.” - Ricoeur, [1990](#)

In this way, person-based care has its phenomenological foundation here: it is born from the encounter between two subjectivities, where the professional and the person cared for coexist in a relationship of ethical reciprocity.

Vulnerability, for Ricoeur, is a constitutive trait of the human condition. It is precisely in vulnerability that care becomes ethical, because the presence of the vulnerable other awakens in me the responsibility to respond. It is an “ethical call” similar to what Emmanuel Levinas describes as the “face of the other”, an interpellation that invites me to care.

“The other is the one who obliges me, even before I choose him.” Ricoeur, [1995](#).

In this sense, responsibility is born of recognition: caring is an act of response to the presence of the other who suffers. Thus, recognition is essential for authentic care to take place, which requires recognizing the other as equal in dignity, but different in individuality. However, “recognizing” is not only identifying, but respecting and valuing the person in their history, body and life project. Care, therefore, is an act of ethical reciprocity, where those who care and those who are cared for mutually transform each other.

“It is through the mediation of the other that I become my-

self.” - Ricoeur, 1990

Ricoeur provides the philosophical basis for understanding person-based care as a relational and ethical experience, not just a technical one.

In clinical practice (nursing and medical) and bioethics, Ricoeur inspires a vision of care that values the interpersonal relationship as a space of meaning, rejects technical or utilitarian reductionism and affirms that the act of caring is always ethical, as it is addressed to a concrete person, bearer of dignity and history, because in the person to be cared for co-responsibility is recognized: Caring and being cared for belong to the same humanity.

1.2.2. Viktor Frankl - Existential Foundation of Care

Viktor Frankl starts from the perspective of logotherapy and the spiritual dimension of the person. Care must be based on the meaning of life and on the interior freedom of the person. Health is more than the absence of disease; it is fullness of meaning. The caregiver helps the other to find meaning again, even in pain. For this author, the person cared for is not only a sick body, but a spiritual and free being, who retains an inner capacity to signify what he lives, even in pain, illness or dependence.

For Frankl, the human encounter is the place where meaning manifests itself. The professional who provides care must welcome the person as a subject, recognizing their suffering, values and history. Care becomes, then, an act of presence and compassion, where the caregiver helps the other to find meaning again, even in the face of vulnerability. Caring is “helping the other to discover meaning, even in suffering”.

2. Ethical and Philosophical Framework - Personalism and Bioethics in Portugal

Portuguese bioethics (born in the 1980s and 1990s) is marked by a fruitful dialogue between science, medicine and philosophy. From the creation of the Center for Bioethics Studies and, later, by the Institute of Bioethics - UCP, an ethical and humanistic model was consolidated, guided by four fundamental axes:

- Dignity of the human person as an absolute principle.
- Recognition of vulnerability as a requirement for care and solidarity.
- Ethical relationship between professional and sick people, based on trust and prudence.
- Social and ecological responsibility of human action.

Bioethical thought in Portugal developed from a solid per-

sonalist tradition, inspired by European philosophical and anthropological currents that affirm the dignity of the human person as the foundation of all ethical action. This view is part of a broader movement of humanistic bioethics, which is opposed to utilitarian, technocratic or merely procedural views of health care.

Portuguese personalism, consolidated by figures such as Daniel Serrão, Walter Osswald and João Lobo Antunes - among other authors, such as Neves Patrão M - and later deepened by Carlos Costa Gomes, today constitutes a structuring ethical reference for reflection on the foundation of care, founded on life and human dignity.

2.1. Personalism as the Foundation of the Ethics of Care

Personalism is based on the idea that the person is the supreme value of moral reality. Unlike ethics centered only on action, consequences, or norms, personalism places the person at the center of morality, recognizing it as an end in itself, endowed with freedom, rationality, relationality, and transcendence. Maria do Céu Patrão Neves¹ integrates the idea of person-centered care into a personalistic bioethics, in which human dignity is the supreme criterion of ethical action. It emphasizes that the person is not only the center of care, but its value and moral purpose.

For Serrão, there is only a disease if there is a person. Therefore, the person is prior to the disease, therefore, by antonomasia, the intrinsic dignity of the person confers on him the substantial and never circumstantial right and duty”. Here is a clear formulation by Serrão about the dignity of the human person as an ethical foundation, regardless of the health condition.

Personalism and Portuguese bioethics offer a profoundly integrative view of the action of caring. It recognizes the inviolable value of the human person and articulates ethics, technique and spirituality, promoting a humanized and prudent clinical practice that underpins the model of person-based care, which assumes the person as the origin, measure and end of the entire act of care, since “caring is more than treating; it is to recognize in the other his dignity and mystery.”

This thought has philosophical roots in Emmanuel Mounier, Jacques Maritain and Karol Wojtyła and finds in Bioethics in Portugal an original expression applied to biomedical practice. In the context of health care, personalism is not limited to respecting rights, it proposes an ethic of recognition and responsibility because caring is responding to the absolute value of the person. More recently, Carlos Costa Gomes deepens and systematizes this tradition through the Ethics of Comple-

¹ Emmanuel Mounier and Jacques Maritain - who saw the person as a being of relationship, whose dignity is concretized in the encounter with the other; Karol Wojtyła - who developed Christian personalism by integrating Kant and the phenomenological tradition: the person is free, rational, relational and open to transcendence (God, the Good, the Other). Daniel Serrão and Carlos Costa Gomes, in Portugal, follow this line when they say that the person is the foundation of ethics because he is a free, conscious, relational and transcendent being.

mentarity, which articulates the dimensions of personalism, bioethical principlism and moral virtues. The ethics of care requires complementarity between principles, people and virtues: a dialogue between rationality and affectivity.”

From this perspective, personalism offers the ontological and axiological foundation - the person as an absolute value; principlism provides normative rationality - autonomy, beneficence, non-maleficence and justice - vulnerability and integrity; The virtues give the practical and prudential dimension - compassion, prudence, empathy and responsibility. Thus, and in this way, care ceases to be a mere technical or procedural act and becomes an integral ethical act, rooted in the dignity and uniqueness of the person.

The act of caring is an intrinsically human act. The foundation of this service is rigorously ethical and takes place within the ethical universe of the person. To serve the other, the vulnerable, is to satisfy their need for fulfillment as a person”. The author emphasizes that care must be founded “on the ethical universe of the person”, recognizing vulnerability and dignity as foundations for the action of caring.

2.2. Daniel Serrão: The Person is the Foundation and Not Just the Center

For Daniel Serrão, the person is the foundation of ethics and bioethics, not just the center of action. He rejects a utilitarian or technocratic view of medicine and proposes a model that recognizes the human being as an “absolute value” - never a means, always an end in itself. For Daniel Serrão, “the human person is always an end and never a means to any end, no matter how noble it may be.”

2.1.2. Difference Between “Person-Centered” and “Person-Based”

Daniel Serrão does not use the expression “person-centered care” (of more Anglo-Saxon origin, linked to nursing and humanistic psychology), but his thought offers an implicit critique of this formulation. In this sense, Serrão states: “if centered care places the person at the center, grounded care starts from the person as the root and ethical end of all care. The implicit critique of the “Person-Centered” does not reject care in this perspective but warns against its ethical superficiality if it does not integrate a complete anthropology. In the light of Serrão’s thought, the “centered” model can privilege individual autonomy, forgetting the relational, spiritual and transcendent dimension of the person, it can transform the ethics of care into an ethics of choice, instead of an ethics of being, which can lead to the lure of becoming instrumental or pragmatic, if it is not founded on the ontological dignity of the person.

We can say that Daniel Serrão transcends the person-centered care model. His thought invites an ethical and ontological evolution of the concept: From person-centered care

logical evolution of the concept: From person-centered care (empathy and autonomy) to person-based care (dignity and transcendence).

2.3. Walter Osswald and the Centrality of the Person in Bioethics

Walter Osswald (1928–2021), a physician and bioethicist, developed a deeply personalistic view of the ethics of care. His thinking recognizes the importance of “person-centered care” but refuses to reduce it only to a clinical or communicational methodology. For Osswald, the centrality of the person must be ethical, ontological and spiritual in nature and not just practical. What is at stake is not only to treat the sick with humanity, but to recognize in him the inalienable dignity of a person.”

2.3.1. Person-Centered Care Is the Starting Point, the Foundation Is Arrival

Osswald sees the person-centered model of care (inspired by Carl Rogers, McCormack, and others) as an important advance over the traditional biomedical model, because it values the autonomy and participation of the person, prioritizes dialogue and empathetic listening, and calls for a more humanized clinical practice.

However, for Walter Osswald, it is not enough if it is not based on a solid anthropological basis. That is, without understanding what the person is, person-centered care runs the risk of becoming an “ethical slogan” without moral depth. Because this author, “to humanize is not just to be kind; it is to recognize the other as a person endowed with absolute value.”

Walter Osswald does not reject the concept but proposes an ethical reformulation. Care must be person-centered, because it is person-based. In other words, “centering” on the individual is important, but it is not enough to recognize preferences, it is necessary to recognize the dignity and moral dimension of the person. The centered model can be too subjective or autonomist, reducing care to individual choice. The model founded on the person, on the other hand, has a solid anthropological basis, integrating body, soul, spirit and community.

Walter Osswald integrates person-centered care within a broader personalistic vision. True “centered” care is ethical only when it is also “person-based,” that is, when it recognizes human dignity, vulnerability and transcendence.

“Technique must be subordinated to ethics, and ethics to respect the person.”

2.4. João Lobo Antunes Calls for a Philosophy of Care that Is Close to “Person-based Care”

João Lobo Antunes (1944–2016) is an unavoidable reference in ethical and humanist reflection on care, and his vision

offers a profoundly complementary reading to that of Walter Osswald and Daniel Serrão but does not formulate a “formal ethical model”. Lobo Antunes develops a “philosophy of care” that is close to “person-based care”, going beyond simple “person-centered care”. As a neurosurgeon and essayist, João Lobo Antunes united science and ethics, technique and humanity, in a discourse where the act of caring is a profoundly human encounter. For this author, “medicine is an encounter between two weaknesses: that of the patient and that of the doctor.” It is in this encounter that he recognizes that the person of the patient is not only the carrier of a disease, but a being with history, values, affections and mystery. The totality that technique, by itself, does not reach.

2.4.1. Person-Centered Care, but with Ethical Density

Lobo Antunes accepts the ideal of person-centered care, especially as a humanisation of medicine and respect for the uniqueness of the sick person. But his approach is not merely communicational, it is ontological and ethical. “The patient is not a clinical case, it is a world that is entrusted to us.” Person-centered care is not limited to “putting the sick person at the center”, it implies recognising their absolute value and our moral responsibility towards the sick person. True care is the relationship between people, not the provision of services. Thus, person-centered care, in Lobo Antunes, gains moral and spiritual depth because it is based, precisely, on the ethical density in the relational universe of the encounter between two people.

3. The “Fallacy” of Person-Centered Care: Bioethical Analysis

In recent decades, the expression “person-centered care” has become a recurring motto in health policies, in the training of professionals and in discourses on the humanization of care. However, Ana Sofia Carvalho warns of the risk of this concept becoming an ethical and anthropological fallacy, when it is used in a superficial or instrumental way, without true foundation in human dignity.

The term “person-centered” can, paradoxically, reinforce an individualistic and isolated view of the subject, if it is misinterpreted. By focusing excessively on “individual autonomy” it can devalue relationships of interdependence, ignore the family, social and cultural context and distance care from its community and solidarity dimension.

In this sense, we consider that the designation of the term “person-centered care” can become a rhetorically humanistic, but ethically empty discourse. According to the author, the concept is fallacious for three main reasons:

- Instrumentalization of the person: The discourse places the person as the “center” of a technical model, but not as a subject of relationship. The language of “centering”

is still a language of power, because it keeps the professional in the role of the one who decides “around” the other.

- Anthropological reduction: The term “person” is used vaguely, without reference to its ontological and ethical dimension. It thus becomes synonymous with “user” or “customer”, losing its absolute value.
- Ethical contradiction: By affirming that care is “centered” on someone, there is a risk of reducing care to a method of managing the patient’s experience, rather than an interpersonal encounter.

“Person-centered care can fall into a fallacy when the person is only the pretext of a technical model of humanization.”

Reading Daniel Serrão’s thought, care should not only be person-centered but person-based. “Centering” refers to a position of focus; The “foundation” refers to an ethical root. Thus, in the logic of Person-Centered Care, the person is the object of care. The focus changes, but the technical logic remains. There is a risk of practicing a technical-formal autonomy or of functional paternalism. In the logic of Person-based care, care is born from the inherent and intrinsic dignity of the person, based on the recognition of a dialogical autonomy and a relationship with responsibility. Therefore, from this perspective, the center is a door, but it is the foundation that matters. Only when care is person-based does it become truly ethical.” Health care is not born from centered models, but from well-founded ethical relationships, where the professional and the person being cared for share responsibilities and meanings.

Ethical care is, therefore, an act of alterity: it is not centered, it is found; it is not measured, it is recognized; it is not managed, it is shared. It invites us to rethink the ethics of care from a personalistic and relational anthropology.

“Person-centered care,” if not critically reviewed, can be a well-intentioned fallacy, a discourse that promises humanization but maintains the logic of objectification. True ethical care is that which recognizes the person as the foundation and end, and not as the center or means, it is an act of recognition, not of centralization. It is an act of ethics and truth.”

The concept of person-centered care is valuable and desirable, but it has serious barriers at the conceptual, normative, and practical levels. There is a risk of confusing discourse with reality - saying “the person at the center” is not enough, it is necessary that practices, structures and policies effectively allow it. Without this, there is a risk that “person-centered” will be just a formulation with no real impact.

4. Ethics of Vulnerability and Responsibility

In UNESCO’s Universal Declaration on Bioethics and Human Rights, approved in October 2005, one of the ethical principles proposed is that of respect for human vulnerability.

Vulnerability and vulnerable are terms that come from the Latin *vulnus*, meaning that entity is subject to injury. Kempe

Rendtorff offers us a clear and succinct notion of the principle of vulnerability: “The principle of vulnerability prescribes, at the foundation of ethics, the respect, care and protection of the others and of the living in general, on the basis of the universal observation of the fragility, finitude and mortality of beings.”

For Maria do Céu Patrão Neves, the word vulnerability can be defined as the susceptibility to being hurt. Thus, all human beings are liable to injury just because they are alive.” For the author, vulnerability as an intrinsic condition of the person reinforces the ethical dimension of care. “Vulnerability, in the adjectivating function with which it is used, is first presented as a fact, on a descriptive level. However, it cannot be considered axiologically neutral, but, rather, it also denotes the expression of values, in the openness to a prescriptive plane.” The vulnerability of the person is therefore presented as an ethical foundation, a requirement of responsibility, respect and care.

João Lobo Antunes approaches the ethics of vulnerability and responsibility, inspired by authors such as Emmanuel Lévinas. It emphasizes that the vulnerability of the other is an ethical call to response and what gives rise to true care. “The vulnerability of the other is a call to our humanity.” Thus, for the author, care is no longer only person-centered (as a technical principle) and is based on the ethical relationship with the person, marked by compassion, prudence and presence. He does not implicitly criticize the “centered” model, he does not reject the term, but he makes a criticism very similar to that of Osswald and Serrão: “Technique can cure, but only presence truly heals.”

João Lobo Antunes goes beyond the technicist vision of the “person-centered”, proposing a model of person-based care and the ethical relationship. From person-centered care — the person as the center of clinical decisions — it prefers the concept of person-based care — the person as the origin and meaning of care, in their vulnerability and mystery — to the extent that care is the most human gesture we can offer: it is not just science, it is encounter.”

5. Implications for Organizations and Entrepreneurship

The transition from person-centered to person-based care has important implications beyond clinical settings, particularly in organizational and entrepreneurial contexts. Contemporary organizations, especially in healthcare, social innovation, and service-based sectors, increasingly recognize that value creation is not only technical or economic, but also relational and ethical.

From an entrepreneurial perspective, person-based care contributes to a deeper understanding of user needs, not merely as preferences, but as expressions of dignity, vulnerability, and meaning. This perspective can inform the design of products, services, and business models that are more responsive, inclusive, and ethically grounded.

In terms of organizational ethics, person-based care challenges purely instrumental approaches to management by emphasizing responsibility, recognition, and relationality. This perspective resonates with stakeholder theory (Freeman, Harrison, & Zyglidopoulos, 2018), which frames organizations as systems of relationships where value is created with and for multiple stakeholders. It also aligns with emerging discussions on responsible innovation, human-centered leadership, and sustainable value creation.

Furthermore, in innovation processes, particularly in health and social sectors, adopting a person-based perspective may enhance user engagement, trust, and long-term impact, contributing to more resilient and socially embedded entrepreneurial ecosystems.

The person-based perspective is closely aligned with the principles of responsible research and innovation (von Schomberg, 2013), emphasizing ethical acceptability, sustainability, and societal desirability.

6. Concluding Summary

Person-based care is an ethical and philosophical evolution of person-centered care. It recognizes the person as the foundation, criterion and purpose of all health action — not only as the center of decision, but as a source of dignity, relationship and transcendence. It is a paradigm that unites science, ethics and spirituality in the same gesture of caring.

“Person-Centered Care” is based on a relational and practical ethic that has its origins in Carl Rogers (humanistic psychology) and McCormack & McCance (nursing), whose scope is understood to be clinical, relational and organizational issues. The ethical contributions are positive in that they valued respect for the autonomy of the person and the promotion of empathy, active listening and respect for uniqueness. It privileges the humanized relationship instead of a dehumanized relationship with a technicist vision, reinforces the ethics of the relationship and the professional dialogue between person and patient.

In terms of ethical limitation, it can be reduced to a communicational or technical model, focused on preferences, and not on values. It runs the risk of moral individualism — caring “as the other wants”, without evaluating whether this is ethically good and beneficent. It focuses more on the shared decision than on the moral foundation of the decision.

“Person-centered” care is ethical based on an ethic of being (ontology) and decision (moral). It is a more deontological and less fundamental humanist paradigm in the wake of ethical depth.

“Person-based care” is based on a personalistic and prudential ethic², looking at the person not only as the center of care, but as its moral foundation and purpose. Ethical action is born from the intrinsic and inherent dignity of the human person, and not only from his or her choices. It values prudence, the

relationship of otherness and transcendence (spiritual dimension). It integrates reason, emotion, and moral virtue with the ethics of practical wisdom (phronesis). He cares not only with technique and empathy, but with ethical wisdom. It recognizes that the person is an absolute value, even when he or she cannot decide (child, elderly, critically ill person), because it is in the person that the origin of the foundation that unites science with ethics and competence with conscience lies.

The concept of “person-based” care does not replace “centered” care, it perfects it. It is the highest ethical form of care, because it recognizes the ontological value of the person as the principle and end of action.

From the perspective of Paul Ricoeur (and also of Viktor Frankl and Walter Osswald, Daniel Serrão...), the person is not only the center of the action of caring, but the foundation of the very meaning of care. This means that caring is not only doing good to the person, but acting for him and with him,

recognizing his intrinsic value, as a value that does not depend on health, utility or autonomy, but on his condition as a human being.

Thus, person-based care rises as the highest ethical form of care, as it transcends mere functional centrality and reaches the ontological and transcendental dimension of human dignity. At this level, caring becomes an act of respect, love and responsibility, in which the other is always considered as an end in itself, never as a means — according to the Kantian principle of morality and Ricoeur’s ethics of solicitude.

In conclusion, person-based care represents the ethical maturity of care: it unites technique with compassion, science with conscience and transforms the encounter between professional and person into a relationship of mutual recognition and existential meaning. It is the point at which care ceases to be just a professional practice and becomes an expression of humanity itself.

Table 1
Comparative Scheme.

Person-Centered Care	Person-Based Care
Relational and participatory approach	Ethical and ontological approach
Valuing the person’s autonomy and lived experience	Recognition of human dignity
Improved communication and person satisfaction	Respect and responsibility in action

The concept — ethical-ontological approach designates a way of understanding and acting that is based on the dignity of the human being as a being, and not only on the circumstances or consequences of actions. “Ethical” refers to moral action, to decisions guided by the good, justice, respect and responsibility. “Ontological” comes from “ontology”, the branch of philosophy that studies being in itself; it concerns what constitutes the essence of the person — his dignity, freedom, rationality, relationality and transcendence.

Thus, the ethical-ontological approach considers that the action of care should be guided not only by moral values, but also by the recognition of the intrinsic value of the person’s being. That is, caring is a duty that is born from what the person is, and not from what he has, does or feels.

- Ethical: asks “how should I act well towards the other?”
- Ontological: it asks “who is the other who asks me for care?”
- “To care ethically is to act according to the good; to care ontologically is to act from the being.”

The concept — participatory relational approach is a way

of understanding and practicing care that values the active participation of the person in decisions, actions and in the evaluation of their own health and well-being process. Instead of seeing the person as a passive recipient of care, this approach recognizes them as a partner, co-responsible and agent in the care process. The person is listened to, respected in their preferences, values and experiences, and actively participates in the planning, execution and evaluation of care.

In person-centered care, the participatory approach is essential — care is built with the person, not for the person. In person-based care, this participation acquires an ethical-ontological sense — participation is seen as an expression of the freedom and dignity of the person, not only as a method of involvement.

In this way, person-based care not only enriches bioethical reflection, but also offers a valuable framework for rethinking organizational practices, innovation strategies, and entrepreneurial approaches grounded in human dignity and ethical responsibility.

² Origin: Personalism (Mounier), Ethics of Complementarity (Carlos Costa Gomes), Personalist Bioethics (Patrão Neves).

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SYMBIOSIS, CO-EVOLUTION, AND RELATIONAL IDENTITY: A HOLOBIONT THEORY OF ORGANIZATIONAL BOUNDARIES

Symbiosis, co-evolution, and relational identity: A holobiont theory of organizational boundaries

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ABSTRACT

Contemporary organizational theory treats boundaries as fixed, jurisdictional, and hierarchically enforced an assumption shared by transaction cost economics, resource dependence theory, and ecosystem frameworks. We argue that this jurisdictional boundary assumption constitutes a fundamental theoretical limitation: it renders boundary permeability theoretically invisible, forecloses a constitutive logic of inter-organizational collaboration, and produces a static conception of organizational identity. To address this gap, we introduce the holobiont a host organism and its symbiotic microbiome functioning as a single co-evolutionary unit as a theoretically generative framework for reconstructing organizational boundaries and collaboration. Drawing on three biological mechanisms constitutive symbiosis, co-evolutionary boundary formation, and emergent identity we develop three formal propositions and identify three boundary conditions under which holobiont logic applies: temporal depth, mutual transformation, and distributed governance. We illustrate the framework's empirical purchase through three paradigmatic cases: the Linux/Apache ecosystem, Toyota's keiretsu supplier network, and biotechnology research consortia. The holobiont framework does not replace existing theories; it identifies the conditions under which they apply and opens new research directions on inter-organizational collaboration, ecosystem governance, and relational organizational identity.

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1. Introduction

The boundaries of organizations have long been treated as self-evident: a firm begins where its legal jurisdiction starts and ends where its contractual authority ceases. This conception, deeply embedded in the foundational texts of organizational theory, from Weber's (1947) bureaucratic model to Williamson's (1981) transaction cost economics and Pfeffer and Salancik's (1978) resource dependence framework, has proven remarkably durable. Yet durability is not the same as adequacy. As contemporary organizations increasingly operate through platform ecosystems, inter-organizational alliances, open innovation networks, and hybrid governance arrangements, the question of where one organization ends and another begins has become not merely empirically ambiguous but theoretically unresolved. Existing frameworks offer powerful tools for explaining why boundaries exist and how they are governed, but they share a common epistemological assumption: that boundaries are fixed, jurisdictional, and hierarchically enforced. It is precisely this assumption that this paper calls into question.

We argue that organizational theory's persistent attachment to hierarchical boundary logic reflects a deeper conceptual limitation one that cannot be resolved from within the tradition itself. Transaction cost theory explains boundary placement as a function of efficiency and opportunism (Williamson, 1981). Resource dependence theory explains boundary management as a response to environmental uncertainty (Pfeffer & Salancik, 1978). Ecosystem and platform theories expand the unit of analysis but retain the assumption that organizational identity is anchored in a stable, recognizable core (Jacobides et al., 2018). None of these frameworks theorizes the boundary as a relational, permeable, and co-evolutionary phenomenon as something that is not drawn once and defended, but continuously negotiated through symbiotic interaction. This theoretical gap is not merely academic. It leaves organizational scholars without adequate conceptual tools to explain how identity, collaboration, and competitive advantage emerge in systems where the line between inside and outside is, by design, never fixed.

To address this gap, we turn to biology specifically to the concept of the holobiont. In evolutionary biology, a holobiont is defined as a host organism together with all of its symbiotic microorganisms, functioning as a single unit of selection and adaptation (Margulis, 1991; Zilber-Rosenberg & Rosenberg, 2008). What makes the holobiont theoretically generative for organizational scholarship is not its biological content per se, but the conceptual architecture it reveals: an entity whose boundary is not anatomical but relational, whose identity is not fixed but emergent, and whose survival depends not on the exclusion of external actors but on the quality of its symbiotic relationships. The holobiont does not ask "who is inside and who is outside?" It asks "with whom am I co-evolving,

and how does that relationship constitute what I am?"

The application of biomimetic reasoning to organizational theory has a legitimate and growing scholarly tradition. Morgan's (1986) seminal work demonstrated that biological metaphors are not decorative devices but epistemological instruments they reveal organizational properties that conventional frameworks render invisible. Subsequent contributions have drawn on a range of biological systems: ant colony optimization to theorize distributed coordination (Bonabeau et al., 1999; Couzin, 2009), immune system dynamics to reconceptualize adaptive organizational resilience (Iansiti & Levien, 2004), and ecological succession models to theorize the evolution of industry architectures (Tushman & Anderson, 1986). More recently, scholars have applied biomimetic reasoning to agile leadership structures, adaptive decentralization, and swarm-based coordination in complex organizational environments (Akkaya & Yazıcı, 2020; Yazıcı, 2023; Yazıcı & Öztürk, 2024). Each of these contributions shares a common move: treating biological systems as structural analogues that make visible the mechanisms underlying organizational phenomena. The present paper extends this tradition by targeting the most foundational unit of organizational analysis the boundary and reconstructing it through the holobiont lens. In doing so, we do not propose a metaphor in the loose sense. We propose a theoretically grounded framework that generates novel propositions about organizational boundaries, collaboration logic, and relational identity.

This paper proceeds as follows. We first review the existing organizational boundary literature, identifying the theoretical gap that hierarchical frameworks leave open. We then introduce the holobiont concept from its biological foundations, explicating the mechanisms of symbiosis, co-evolution, and functional integration that constitute holobiont identity and that we subsequently translate into organizational terms. Drawing on these foundations, we develop a holobiont organizational framework centered on three formal propositions: that organizational boundaries are most productively theorized as permeable and relational rather than fixed and jurisdictional; that collaboration logic in holobiont organizations operates through symbiotic co-evolution rather than transactional exchange or hierarchical coordination; and that organizational identity in holobiont systems is emergent and relational rather than stable and self-contained. We conclude by discussing the implications of this framework for organizational theory, identifying productive points of dialogue with transaction cost theory, resource dependence theory, and ecosystem frameworks, and outlining an agenda for future empirical research.

This paper makes three contributions to organizational theory. First, it reconceptualizes organizational boundaries as relational and permeable phenomena, challenging the jurisdictional assumptions embedded in transaction cost and resource dependence frameworks. Second, it introduces the holobiont

as a theoretically rigorous biomimetic framework distinct from prior biological metaphors in its capacity to theorize boundary permeability, symbiotic collaboration, and relational identity simultaneously. Third, it generates a set of formal propositions that bridge evolutionary biology and organization theory, opening new directions for empirical research on inter-organizational collaboration, ecosystem governance, and organizational identity.

2. Theoretical Background and Literature Gap

2.1. The Hierarchical Foundations of Organizational Boundary Theory

The concept of organizational boundaries has been theorized primarily through the lens of hierarchy, control, and efficiency. Weber's (1947) foundational model of bureaucracy established the organization as a rationally ordered system of authority, in which roles, responsibilities, and jurisdictions are clearly delineated. Within this framework, the boundary of the organization is coextensive with its authority structure: the organization extends as far as its legitimate command reaches and no further. This conception, while analytically powerful, encodes a specific assumption about the nature of boundaries that they are fixed, enforceable, and defined by the exclusion of external actors from internal decision-making processes.

Transaction cost economics (TCE) deepened this logic by grounding boundary decisions in efficiency calculations. Williamson (1981) argued that the boundary of the firm is determined by the relative costs of market exchange versus hierarchical coordination: activities are internalized when the transaction costs of market governance opportunism, asset specificity, uncertainty exceed the costs of administrative control. In TCE, the boundary is not merely a jurisdictional line but an economizing device. Yet the fundamental assumption remains intact: the boundary separates inside from outside, and the organization's task is to manage this separation efficiently. The boundary is a solution to the problem of opportunism, not a site of generative relationship.

Resource dependence theory (RDT) shifted attention from efficiency to power, arguing that organizations manage their boundaries in response to environmental uncertainty and resource scarcity (Pfeffer & Salancik, 1978). Boundary-spanning activities mergers, joint ventures, board interlocks, long-term contracts are understood as strategies for reducing dependence on external actors and securing critical resources. RDT introduced a more dynamic view of boundaries, acknowledging that organizations actively work to reshape their relationships with the environment. Nevertheless, the underlying logic remains hierarchical: the organization seeks to absorb, control, or neutralize external dependencies. The boundary is a defensive perimeter, and the goal of boundary management is to extend organizational control outward rather than to dis-

solve the distinction between inside and outside.

More recent contributions have expanded the unit of analysis beyond the individual firm to encompass ecosystems, platforms, and networks (Jacobides et al., 2018; Adner, 2017). Ecosystem theory acknowledges that value creation increasingly occurs across organizational boundaries, through complementary relationships among multiple actors. Platform theory recognizes that some organizations deliberately open their boundaries to external developers, users, and partners as a source of competitive advantage. These frameworks represent significant advances over TCE and RDT in their capacity to theorize inter-organizational interdependence. Yet they retain a residual hierarchical assumption: even in ecosystems and platforms, there is a recognizable core the keystone firm, the platform owner whose identity, authority, and strategic intent anchor the system. The boundary may be more permeable than in classical theory, but it is still fundamentally a boundary between a defined organizational center and its external environment.

2.2. The Theoretical Gap: Boundary Permeability as a Generative Property

Taken together, these frameworks share what we term the *jurisdictional boundary* assumption: the view that organizational boundaries are, at their core, demarcations of authority, ownership, and control. This assumption has three interrelated consequences for organizational theory. First, it renders boundary permeability theoretically invisible or at best, theoretically marginal. Permeability is treated as a problem to be managed (RDT), a cost to be minimized (TCE), or a strategic choice made by a bounded core actor (ecosystem theory). It is never theorized as a constitutive property of organizational identity as something that makes the organization what it is rather than threatening what it is.

Second, the jurisdictional boundary assumption forecloses a particular kind of collaboration logic. Within hierarchical frameworks, inter-organizational collaboration is fundamentally transactional or relational in the dyadic sense: two bounded actors exchange resources, share risks, or pool capabilities while remaining fundamentally separate entities. The possibility that collaboration might be constitutive that organizations might become what they are through their symbiotic relationships rather than despite them is theoretically unthinkable within the jurisdictional framework. This is not a minor gap. It means that organizational theory currently lacks the conceptual vocabulary to describe what happens when the boundary between collaborating organizations becomes not just permeable but generative.

Third, the jurisdictional boundary assumption produces a static conception of organizational identity. In classical and neoclassical frameworks, the organization has a stable identity a defined set of resources, capabilities, and strategic intentions

that precedes and grounds its boundary decisions. Identity is the anchor; the boundary is the expression of that identity in space. This conception struggles to account for organizations whose identity is itself relational and emergent whose “what we are” is inseparable from “with whom we are co-evolving.” Platform firms, open innovation ecosystems, and inter-organizational communities of practice all exhibit this property to varying degrees, yet organizational theory has no framework that places relational identity at the center of its analysis.

Santos and Eisenhardt (2005) came closest to addressing this gap in their influential typology of organizational boundaries, distinguishing among efficiency, power, competence, and identity conceptions of the boundary. Their identity conception in which boundaries define “who we are” rather than merely “what we control” opens theoretical space for a more relational account. Yet even Santos and Eisenhardt ultimately anchor identity in a stable organizational core, treating boundary decisions as expressions of a pre-given organizational self rather than as processes through which the self is continuously constituted. The gap remains: organizational theory needs a framework in which identity, boundary, and collaboration are not three separate phenomena to be related but three dimensions of a single relational process.

2.3. Biological Metaphors in Organizational Theory: Promise and Limitation

Organizational theorists have long recognized the generative potential of biological reasoning. Morgan's (1986) canonical work identified the organism metaphor as one of the most productive lenses through which organizational phenomena can be understood, revealing properties adaptation, metabolism, lifecycle, interdependence that mechanical metaphors render invisible. Subsequent work has drawn productively on a wide range of biological systems: ant colony dynamics to theorize collective intelligence and emergent coordination without central command (Bonabeau et al., 1999; Couzin, 2009), ecological succession and keystone species models to theorize industry evolution and platform dominance (Iansiti & Levien, 2004; Tushman & Anderson, 1986), and immune system architecture to reconceptualize adaptive organizational responses to environmental threats (Anderson, 1999). More recently, scholars have extended biomimetic reasoning to agile and adaptive leadership structures, decentralized organizational decision-making, and swarm-based autonomous coordination in complex systems (Akkaya & Yazıcı, 2020; Yazıcı & Öztirak, 2024).

Each of these contributions demonstrates the epistemological productivity of biomimetic reasoning in organizational theory: biological systems make visible organizational mechanisms that conventional frameworks, anchored in assumptions of rationality, hierarchy, and bounded agency, cannot easily see. Nevertheless, existing biomimetic frameworks in or-

ganizational theory share a significant limitation: they import biological mechanisms to explain organizational processes coordination, leadership, adaptation while leaving the boundary itself theoretically intact. Ant colonies illuminate how organizations coordinate without central command, but they do not challenge the assumption that the organization has a fixed boundary. Gray wolf dynamics illuminate how leadership can be distributed and contextual, but the pack remains a bounded entity. Even holographic organizational theory, which explicitly theorizes the whole as present in every part, does not fundamentally reconceptualize where the organization ends.

It is here that the holobiont concept offers something genuinely new. Unlike prior biological analogues applied to organizational theory, the holobiont does not merely describe a mechanism within a bounded system. It challenges the boundedness of the system itself. In the holobiont, the question “where does the organism end?” does not have a stable anatomical answer it has only a relational one. The identity of the holobiont is constituted by its symbiotic relationships, and its boundary is a function of those relationships rather than their precondition. This is precisely the conceptual architecture that organizational theory currently lacks, and it is the foundation on which we build our theoretical framework in the sections that follow.

3. The Holobiont: Biological Foundations and Theoretical Transfer

3.1. Origins and Definition

The holobiont concept has its intellectual roots in the work of Lynn Margulis, whose theory of symbiogenesis fundamentally challenged the neo-Darwinian view of evolution as a process driven exclusively by competition and random mutation (Margulis, 1991). Margulis demonstrated that the eukaryotic cell the basic unit of all complex life is itself a product of symbiotic merger: mitochondria and chloroplasts, once free-living bacteria, were incorporated into host cells through endosymbiosis, eventually becoming indispensable components of a new integrated organism. The implications were profound: what appeared to be a single, bounded biological entity was in fact a co-evolutionary assemblage of formerly distinct organisms. The boundary of the organism, far from being a fixed anatomical fact, was revealed as a historical and relational achievement.

Building on this foundation, Zilber-Rosenberg and Rosenberg (2008) formally proposed the holobiont as the unit of natural selection, arguing that the host organism and its associated microbiome the totality of bacteria, fungi, viruses, and other microorganisms that inhabit it function together as a single evolutionary unit. In their framework, the holobiont is not the host plus its microbiome as two separate entities in a relationship; it is a new kind of entity whose properties emerge

from the integration of host and symbionts. Fitness, adaptation, and survival are properties of the holobiont as a whole, not of its components in isolation. Subsequent research in evolutionary biology and microbiology has substantially supported and extended this view, demonstrating that the microbiome is not peripheral to host biology but constitutive of it shaping immune function, metabolic capacity, neurological development, and behavioral repertoires in ways that cannot be attributed to host genetics alone (Gilbert et al., 2012).

3.2. Three Constitutive Mechanisms

For the purposes of theoretical transfer to organizational analysis, we identify three constitutive mechanisms of the holobiont that are analytically distinct and collectively generative: symbiosis, co-evolution, and emergent identity. Each mechanism corresponds to a theoretical gap identified in our review of organizational boundary literature, and each will ground one of the formal propositions we develop in the following section.

Symbiosis as a constitutive relationship. In biological usage, symbiosis refers to a close and persistent interaction between two or more different organisms. Crucially, symbiosis is not a transactional exchange between pre-constituted entities; it is a relationship that transforms the entities involved. The gut microbiome does not merely assist the host in digesting food; it shapes the host's immune system, influences its behavioral responses to stress, and co-regulates its developmental processes (Gilbert et al., 2012). The host, reciprocally, provides the microbiome with a stable environment, nutritional resources, and protection from external competition. Neither party is the same entity it would be in the absence of the relationship. This is what distinguishes symbiosis from transaction: transactions occur between stable entities and leave their identities intact, while symbiosis constitutes the entities through the relationship itself.

Co-evolution as a boundary process. In the holobiont, the boundary between host and symbiont is not fixed at a moment in time and subsequently defended; it is continuously renegotiated through co-evolutionary processes. The composition of the microbiome changes in response to environmental conditions, host behavior, and inter-microbial competition, and the host's biological systems adapt in response to these changes. What counts as "inside" the holobiont which microorganisms are integrated into its functional identity is therefore not a property of the holobiont at any given moment but a process unfolding over evolutionary and developmental time. This has a profound implication: the boundary of the holobiont is not a precondition of its identity but a consequence of its relational history. Boundaries are outcomes of co-evolutionary processes, not inputs to them.

Emergent identity. Perhaps the most theoretically challenging property of the holobiont is that its identity what it is,

what it can do, how it responds to environmental challenges is irreducibly emergent. It cannot be predicted from the properties of the host genome alone, nor from the properties of any individual symbiont. It emerges from the integrated functioning of the holobiont as a whole, including the dynamic interactions among its microbial inhabitants and between those inhabitants and the host. Gilbert et al. (2012) captured this succinctly in their argument that the holobiont challenges the very concept of the individual organism: if identity is emergent and relational, then the individual is not a natural kind but a theoretical convenience a useful but ultimately provisional boundary drawn around a subset of a larger co-evolutionary process.

3.3. The Epistemological Basis of Theoretical Transfer

Before proceeding to develop our organizational framework, we address directly the epistemological question that any biomimetic theoretical contribution must answer: on what basis can mechanisms identified in biological systems be transferred to organizational analysis? This question is not merely procedural; it goes to the heart of what organizational theory is doing when it draws on biology.

We follow Morgan (1986) and Tsoukas (1991) in treating theoretical transfer not as analogy in the decorative sense where biological language is borrowed to make organizational phenomena seem more vivid but as structural homology in the analytical sense: the claim that two different systems share a common underlying structure, such that mechanisms identified in one illuminate mechanisms obscured in the other. The validity of structural homology does not rest on the similarity of surface features but on the isomorphism of relational structures. We do not claim that organizations are holobionts in any literal sense. We claim that the relational structure of the holobiont constitutive symbiosis, co-evolutionary boundary formation, and emergent identity is homologous to relational structures present in certain organizational phenomena that existing theory cannot adequately explain.

This epistemological position is consistent with a growing body of biomimetic organizational research and with the broader tradition of analogical reasoning in social science. Ecological models of industry dynamics (Hannan & Freeman, 1977; Tushman & Anderson, 1986) established that biological mechanisms of variation, selection, and retention illuminate organizational processes that efficiency-based frameworks cannot see. More recent applications have demonstrated structural homology between immune system architecture and adaptive organizational resilience (Anderson, 1999), between ant colony optimization and distributed decision-making in complex systems (Bonabeau et al., 1999), and between agile leadership structures and predator pack dynamics (Akkaya & Yazıcı, 2020). In each case, the theoretical transfer is justified not by surface resemblance but by the capacity of the

biological structure to reveal organizational mechanisms that conventional frameworks render invisible. The criterion for valid structural homology, as Tsoukas (1991) established, is the isomorphism of relational structures across domains not descriptive similarity between surface features. The holobiont framework satisfies this criterion precisely: the relational architecture of constitutive symbiosis, co-evolutionary boundary formation, and emergent identity maps onto organizational phenomena that existing theory cannot adequately explain, not because organizations resemble biological organisms superficially, but because both systems instantiate the same underlying relational logic.

4. The Holobiont Organization: A Theoretical Framework

4.1. Conceptual Foundations

The holobiont organizational framework we develop in this section is built on a single foundational claim: that the most theoretically productive unit of organizational analysis is not the bounded firm but the relational assemblage the constellation of actors, relationships, and co-evolutionary processes through which organizational identity, capability, and bound-

ary are simultaneously constituted. This claim does not require us to abandon existing organizational theory; it requires us to relocate its foundational assumptions. Where transaction cost theory asks “how should the boundary be drawn to minimize governance costs?”, the holobiont framework asks “how does the boundary emerge from the quality of symbiotic relationships?” Where resource dependence theory asks “how should the organization manage its boundary to reduce environmental uncertainty?”, the holobiont framework asks “how does environmental interdependence constitute what the organization is?” The shift is not from one answer to another but from one question to another and it is in the reframing of the question that the theoretical contribution lies.

We organize the holobiont organizational framework around three analytically distinct but mutually constitutive dimensions: boundary permeability as a generative property, symbiotic collaboration logic, and relational organizational identity. Each dimension is grounded in the biological mechanisms identified in the previous section, translated into organizational terms through the principle of structural homology, and formalized in a theoretical proposition. Together, the three propositions constitute a coherent theoretical framework that addresses the gaps identified in our literature review.

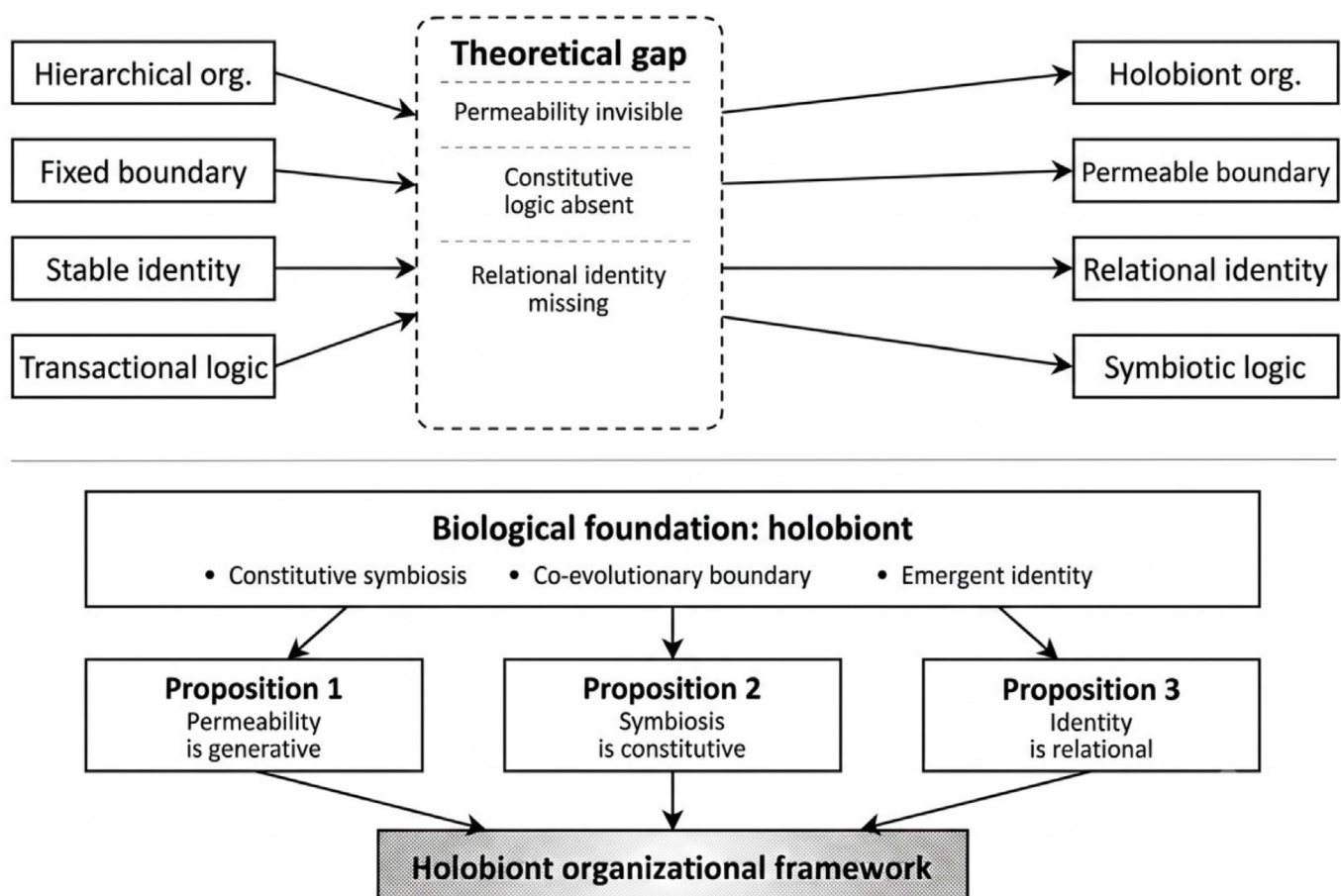


Figure 1: The holobiont organizational framework: from jurisdictional to relational boundaries.

Source: Author's own design.

4.2. Dimension One: Boundary Permeability as a Generative Organizational Property

In classical organizational theory, boundary permeability is a problem. Porous boundaries expose the organization to opportunism (Williamson, 1981), resource dependence (Pfeffer & Salancik, 1978), and identity dilution (Santos & Eisenhardt, 2005). The managerial task is to calibrate permeability opening the boundary enough to access external resources while closing it enough to protect internal capabilities and maintain organizational coherence. Permeability is instrumentally valuable but intrinsically threatening; it is to be managed, not embraced.

The holobiont framework inverts this logic. In biological holobionts, boundary permeability is not a concession to environmental pressure but the mechanism through which the holobiont constitutes itself. The continuous exchange of metabolic products, genetic material, and regulatory signals between host and microbiome is not a compromise of the holobiont's integrity; it is the process through which that integrity is produced and maintained. A holobiont with impermeable boundaries would not be a more coherent organism; it would be a dead one. Permeability, in the holobiont, is generative rather than threatening it is the condition of possibility for the emergence of properties that no component of the holobiont possesses alone.

Translated into organizational terms, this suggests a fundamental reconceptualization of what boundary permeability does for organizations. Rather than treating permeability as a variable to be optimized more or less open depending on environmental conditions and strategic intent the holobiont framework treats permeability as the generative mechanism through which organizational capabilities, identity, and competitive advantage are produced. Organizations that engage in deep, persistent, and constitutive exchange with external actors suppliers, partners, customers, regulators, communities do not merely access external resources; they become different kinds of organizations through that exchange. Their capabilities are not portable assets that exist independently of their relational context; they are emergent properties of the relational assemblage as a whole.

This has direct implications for how we theorize the relationship between boundary permeability and organizational performance. Existing frameworks predict a curvilinear relationship: moderate permeability optimizes the trade-off between access and protection, while excessive permeability undermines organizational coherence and competitive distinctiveness. The holobiont framework predicts a different pattern: the relationship between permeability and organizational capability is not curvilinear but conditional on the quality of symbiotic relationships. High permeability in the context of constitutive symbiosis generates emergent capabilities that bounded organizations cannot replicate; high permeability in

the context of transactional exchange generates vulnerability without compensating advantage. The critical variable is not the degree of permeability but its relational character.

This reasoning generates our first formal proposition:

Proposition 1: Organizational boundary permeability functions as a generative rather than merely instrumental property when it operates through constitutive symbiotic relationships; under these conditions, permeability produces emergent organizational capabilities that cannot be attributed to any individual actor within the relational assemblage and that bounded organizational forms cannot replicate through hierarchical coordination or transactional exchange. Empirical indicators of this proposition include: (a) positive associations between inter-organizational boundary permeability and innovative output that persist after controlling for resource access and information spillovers; (b) the non-portability of capabilities developed through constitutive symbiosis such capabilities should degrade when the relational context is disrupted, even when individual human capital is retained; and (c) the presence of emergent competencies that neither partner possessed prior to the relationship and that neither can articulate as a discrete transferable asset.

4.3. Dimension Two: Symbiotic Collaboration Logic

Existing organizational theory recognizes two primary logics of inter-organizational collaboration: transactional exchange, in which bounded actors exchange discrete resources or services at negotiated prices (Williamson, 1981), and relational governance, in which repeated interaction, trust, and shared norms reduce transaction costs and enable more flexible cooperation (Macneil, 1980; Dyer & Singh, 1998). Both logics share the assumption that collaboration occurs between pre-constituted organizational entities whose identities are stable prior to and independent of the collaborative relationship. The collaboration is a means to an end resource acquisition, risk sharing, capability access not a process through which the collaborating organizations become what they are.

The holobiont framework introduces a third collaboration logic that we term symbiotic co-evolution. In biological holobionts, the relationship between host and microbiome is neither transactional nor merely relational in the dyadic sense; it is constitutive and co-evolutionary. The host does not merely use the microbiome as a resource; it co-evolves with it, such that the host's biological identity its immune repertoire, its metabolic capacity, its developmental trajectory is shaped by and inseparable from the microbial relationships it sustains. Reciprocally, the microbiome's composition, diversity, and functional profile are shaped by the host environment. Neither party remains what it was before the relationship; both are transformed through it, and the transformation is ongoing rather than completed at a single point in time.

Translated into organizational terms, symbiotic collabora-

tion logic describes a mode of inter-organizational relationship in which the collaborating organizations are mutually constituted through their interaction in which the capabilities, identity, and strategic orientation of each organization are shaped by and inseparable from the relational assemblage in which it participates. This is distinct from strategic alliance logic, in which organizations pool resources while maintaining separate identities, and from ecosystem logic, in which organizations occupy complementary roles within a value architecture defined by a platform owner. In symbiotic collaboration, there is no stable prior identity that enters the relationship and no fixed role within a pre-defined architecture; there is only the ongoing co-evolutionary process through which organizational identities and capabilities are simultaneously produced.

This reasoning generates our second formal proposition:

Proposition 2: Symbiotic collaboration logic characterized by constitutive mutual transformation, co-evolutionary

capability development, and the absence of stable prior organizational identities produces forms of inter-organizational competitive advantage that transactional exchange logic and relational governance logic cannot generate; specifically, symbiotic collaboration produces emergent system-level capabilities whose value is irreducible to the sum of the participating organizations' individual capabilities. Empirical indicators include: (a) positive network centrality effects on organizational performance that exceed what can be explained by resource access or information brokerage alone; (b) evidence that collaborating organizations are constitutively transformed over the course of their relationship measurable as changes in core capability profiles, not merely in peripheral competencies; and (c) capability degradation following the dissolution of symbiotic relationships even in the absence of personnel loss, indicating that the capability was a property of the assemblage rather than of the individual organization.

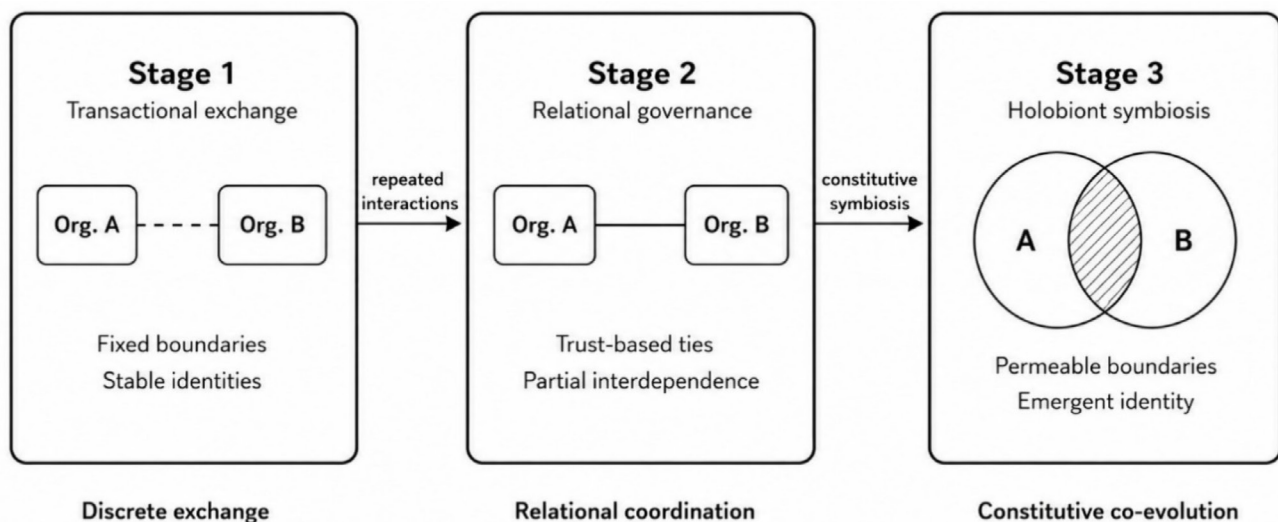


Figure 2: The transition from transactional exchange to holobiont symbiosis.

Source: Author's own design.

4.4. Dimension Three: Relational Organizational Identity

The question of organizational identity what an organization is, what makes it distinctive, what persists through change has been theorized primarily in terms of stability and boundedness. Albert and Whetten's (1985) foundational framework defines organizational identity as the central, distinctive, and enduring characteristics of an organization properties that are stable across time and distinguish the organization from others. This conception, while analytically influential, encodes a specific ontological assumption: that organizational identity is a property of the organization as a bounded entity, not a property of its relationships. Identity precedes relationship; the organization enters its relational environment with an identity already formed, and the task of boundary management is in part to protect that identity from relational contamination.

The holobiont framework challenges this assumption at its foundation. In biological holobionts, identity is not a property of the host organism considered in isolation; it is a property of the holobiont as a relational assemblage. The immune system that defends the "self" against foreign invaders is itself shaped by the microbiome the very symbionts that might appear to threaten the integrity of the self are constitutive of the self's capacity to recognize and respond to genuine threats. Organizational identity, viewed through the holobiont lens, is similarly relational and emergent: it is not what the organization is before it enters its relationships but what it becomes through them. Identity is not the anchor of boundary decisions; it is their emergent outcome.

This reconceptualization has significant implications for organizational theory. It suggests that the stability of organizational identity the sense in which an organization remains

“the same organization” through change is not produced by maintaining a fixed set of core characteristics but by sustaining a coherent pattern of relational engagement. An organization that maintains the same symbiotic relationships while continuously transforming its capabilities, structures, and strategies exhibits a form of identity continuity that Albert and Whetten’s framework cannot capture. Conversely, an organization that maintains stable internal characteristics while its relational context is disrupted may experience a more profound identity crisis than one that transforms internally while sustaining relational coherence.

This reasoning generates our third formal proposition:

Proposition 3: Organizational identity in holobiont organizational forms is relationally constituted and co-evolutionarily maintained; under conditions of deep boundary permeability and symbiotic collaboration, identity continuity is a

function of relational pattern coherence rather than internal characteristic stability, such that organizations can undergo radical internal transformation while maintaining identity continuity through the preservation of their constitutive symbiotic relationships. Empirical indicators include: (a) greater stakeholder perception of identity continuity in organizations that maintain relational network stability through periods of internal restructuring, compared with organizations that preserve internal characteristics while undergoing relational disruption; (b) evidence that organizational reputation and legitimacy assessments by external actors track relational network position more closely than internal capability profiles in high-interdependence industries; and (c) longitudinal patterns in which organizational identity claims shift systematically following the gain or loss of constitutive relational partners, even absent changes in formal mission, leadership, or resource base.

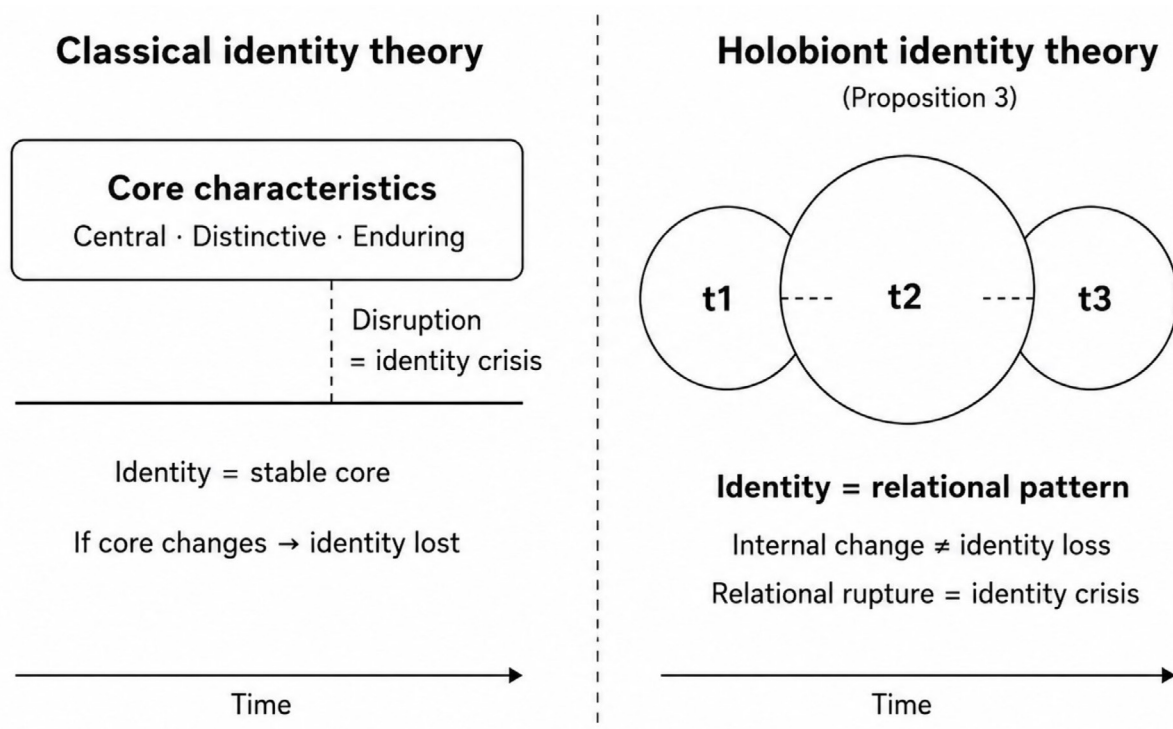


Figure 3: Classical versus holobiont conceptions of organizational identity continuity.

Source: Author’s own design.

4.5. The Holobiont Framework: An Integrated View

The three propositions developed above are analytically distinct but theoretically integrated. Proposition 1 establishes that boundary permeability is generative rather than merely instrumental when it operates through constitutive symbiosis. Proposition 2 establishes that symbiotic collaboration logic produces emergent competitive advantages that bounded organizational forms cannot replicate. Proposition 3 establishes that organizational identity in holobiont systems is relationally constituted and co-evolutionarily maintained. Together, they

constitute a coherent theoretical framework in which boundary, collaboration, and identity are not three separate phenomena to be related but three dimensions of a single relational process the process through which the holobiont organization continuously constitutes itself through its symbiotic engagements with its environment.

This integrated view has a direct implication for organizational theory: it suggests that the most important unit of analysis for understanding competitive advantage, organizational resilience, and strategic adaptation in complex environments is not the bounded firm but the relational assemblage the holo-

biont organization and the co-evolutionary web of relationships through which it is constituted. This does not render existing theories obsolete; it repositions them as special cases of a more general framework in which hierarchical boundary logic applies when relational assemblages are not yet formed or have broken down, and holobiont logic applies when constitutive symbiosis is the dominant mode of organizational existence.

4.6. Illustrative Organizational Cases

To render the holobiont framework's theoretical claims tractable and to demonstrate their empirical purchase, we briefly examine three organizational cases that exhibit holobiont properties in paradigmatic form. These cases are not presented as definitive evidence for the framework's propositions; they are offered as existence proofs demonstrations that the phenomena the framework theorizes are empirically present and organizationally consequential, and that existing theories cannot adequately account for them.

The Linux/Apache open-source ecosystem. What began as a loosely coordinated network of volunteer developers has co-evolved over three decades into a system in which the identities, technical capabilities, and strategic orientations of participating organizations IBM, Red Hat, Google, Intel, and thousands of smaller contributors are inseparable from their participation in the shared codebase (West & Gallagher, 2006; Dahlander & Magnusson, 2008). No participant enters the ecosystem with a stable prior identity that is merely expressed through contribution; each is constitutively shaped by the relational logic of open-source co-development. The boundary between IBM-as-firm and Linux-as-community is not anatomical but relational, continuously renegotiated through each commit cycle. Proposition 1 is directly illustrated: the permeability of IBM's boundary to the Linux commons is not a risk to be managed but the generative mechanism through which IBM's infrastructure capabilities are produced and renewed. Proposition 3 is equally visible: Red Hat's organizational identity what it was, what it could offer, why it was acquired by IBM for \$34 billion in 2019 was a property of its relational position within the ecosystem, not of any internal characteristic it possessed independently of that position (West & Gallagher, 2006).

Toyota's keiretsu supplier network. Toyota's relationship with its first-tier suppliers is instructive because it has been interpreted through both TCE and relational governance frameworks and both, we argue, miss its most theoretically significant properties. Dyer and Nobeoka (2000) documented how Toyota's supplier network functions not as a set of bilateral exchange relationships governed by long-term contracts but as a knowledge-sharing community in which suppliers' production capabilities, quality standards, and problem-solving routines are constitutively shaped by their participation in the network. The Toyota Production System does not ex-

ist within Toyota; it exists within the relational assemblage of Toyota and its suppliers, and no participant could replicate

it independently. Denso, Aisin, and Toyota Boshoku do not merely supply components; their organizational identities engineering culture, investment priorities, management practices have co-evolved with Toyota's over decades of constitutive symbiosis. Proposition 2 is directly illustrated: the emergent system-level capability represented by the Toyota Production System is irreducible to the sum of any individual participant's capabilities, and cannot be transferred or replicated outside the relational assemblage a prediction empirically supported by Toyota's consistently mixed results in replicating TPS quality in greenfield plants without established supplier networks (MacDuffie, 1995).

Biotechnology research consortia. The pre-competitive research consortia that characterize the biotechnology and pharmaceutical industries exemplified by the Structural Genomics Consortium, the Innovative Medicines Initiative, and open-science networks underlying COVID-19 vaccine development offer a third paradigmatic case. Powell et al. (1996), in one of the most influential empirical studies of inter-organizational knowledge creation, demonstrated that in biotechnology, the locus of innovation is the network rather than the firm: organizations more deeply embedded in constitutive inter-organizational relationships exhibit higher innovative performance not because they access more external resources but because their research capabilities are properties of the relational assemblage. A small biotechnology firm's scientific identity what it can do, what problems it can solve is inseparable from its network position. When that relational context is disrupted when a consortium dissolves, when a key partner is acquired the firm's capabilities do not remain intact: they disintegrate, because they were never properties of the firm alone. This is precisely the dynamic that Proposition 3 predicts and that TCE and RDT, with their assumptions of stable organizational capability endowments, cannot explain.

These three cases illuminate an important boundary condition for the framework. In each case, constitutive symbiosis is characterized by three identifiable properties: (1) temporal depth relationships sustained over years or decades; (2) mutual transformation each party's core capabilities are shaped by the relationship, not merely supplemented; and (3) distributed governance the assemblage is not governed by a stable architectural center but through shared norms, standards, and relational trust. Where these conditions are absent where relationships are episodic, instrumental, and hierarchically governed the holobiont framework does not apply, and TCE or ecosystem theory remains more appropriate. This three-condition specification guards against theoretical overextension: the claim is not that all inter-organizational relationships are constitutively symbiotic, but that an important and growing class of them are, and that this class is empirically identifiable.

5. Dialogue with Existing Theories

5.1. Positioning the Holobiont Framework

A theoretical contribution to organizational scholarship is evaluated not only by the novelty of the framework it proposes but by the precision with which it locates itself within the existing theoretical landscape. A framework that claims to explain everything explains nothing; a framework that identifies exactly what it adds to, where it departs from, and what it leaves untouched within existing theory demonstrates

the kind of theoretical self-awareness that AMR's reviewers expect. In this section, we therefore engage directly with the three theoretical traditions most relevant to our framework: transaction cost economics, resource dependence theory, and ecosystem/platform theory not to dismiss them but to map the precise contours of our contribution relative to theirs. We then address the limitations of the holobiont framework itself, in the spirit of theoretical honesty that rigorous conceptual work requires. Table 1 presents a comparison of organizational boundary theories.

Table 1

Comparison of organizational boundary theories

Source: Author's own design.

Theory	Boundary logic	Collaboration logic	Identity conception	Scope limitation
Transaction cost economics	Efficiency-based; fixed boundary around cost-minimizing demarcation	Transactional exchange between pre-constituted entities	Stable, pre-given; protected from relational contamination	Cannot theorize constitutive inter-organizational relationships
Resource dependence theory	Power-based; defensive perimeter against environmental pressure	Dependency management; cooperation as control strategy	Stable, autonomous; threatened by dependence	Cannot theorize organizations constituted by their environment
Ecosystem / platform theory	Architectural; defined by platform owner at system level	Complementary role-filling within governed architecture	Anchored in keystone firm; residual hierarchical centrism	Cannot theorize systems without a stable architectural center
Holobiont framework	Relational; permeable boundary as generative property	Symbiotic co-evolution; constitutive mutual transformation	Emergent and relational; sustained through relational pattern	Most applicable to constitutive symbiotic organizational forms

5.2. Transaction Cost Economics: From Efficiency to Constitution

Transaction cost economics remains the most influential framework for theorizing organizational boundaries, and our engagement with it must therefore be both respectful and precise. Williamson's (1981) framework offers a powerful and internally consistent account of why boundaries exist where they do: activities are internalized when the costs of market governance generated by asset specificity, uncertainty, and the threat of opportunism exceed the costs of hierarchical coordination. This is a genuine theoretical achievement, and the

holobiont framework does not challenge it within its own domain of application.

What the holobiont framework challenges is the scope of that domain. TCE's boundary logic applies most powerfully when inter-organizational relationships are discrete, transactional, and governed by the threat of opportunism when, in other words, the parties to the relationship remain fundamentally separate entities whose identities and capabilities are independent of the relationship itself. This is precisely the condition under which TCE's make-or-buy calculus is meaningful. But it is not the condition that obtains in holobiont organizational forms. When organizations are constitutively

transformed by their symbiotic relationships when their capabilities, identities, and strategic orientations are emergent properties of the relational assemblage rather than portable assets that preexist the relationship the TCE question “should this activity be internalized or outsourced?” becomes theoretically malformed. You cannot internalize or outsource a relationship that constitutes you; you can only sustain it or dissolve it, and the consequences of dissolution are not efficiency losses but identity disruptions.

The holobiont framework therefore does not replace TCE; it identifies the boundary of TCE’s explanatory domain and proposes a complementary framework for the organizational phenomena that lie beyond it. When relationships are transactional, TCE applies. When relationships are constitutive, the holobiont framework applies. The theoretical contribution is the identification and theorization of the constitutive case a case that TCE’s foundational assumptions render invisible.

5.3. Resource Dependence Theory: From Control to Co-evolution

Resource dependence theory shares with TCE a fundamental assumption about organizational agency: organizations are bounded actors that strategically manage their relationships with the environment in order to secure resources, reduce uncertainty, and extend their control over critical dependencies (Pfeffer & Salancik, 1978). RDT’s contribution was to make the political and power dimensions of boundary management visible to show that boundary decisions are not merely efficiency calculations but moves in an ongoing struggle for autonomy and control. This is a genuine and enduring theoretical achievement.

The holobiont framework engages RDT at the level of its foundational metaphor. RDT conceives of the organization-environment relationship as fundamentally adversarial: the environment threatens the organization with dependence, and the organization responds by seeking to reduce, absorb, or neutralize that dependence. Even cooperative strategies joint ventures, interlocking directorates, long-term contracts are understood within RDT as mechanisms for managing dependence rather than as relationships through which the organization is constituted. The environment is something to be managed, not something to be symbiotic with.

The holobiont framework proposes a different foundational metaphor: not the organization struggling to maintain autonomy against environmental pressure, but the organization co-evolving with its relational environment in a process through which both are transformed. This is not merely a rhetorical shift; it has substantive theoretical consequences. Where RDT predicts that organizations will seek to minimize dependence on any single external actor, the holobiont framework predicts that organizations engaged in constitutive symbiosis will actively deepen their interdependence with

key relational partners not because they have failed to manage their dependencies but because deepening interdependence is the mechanism through which emergent capabilities are produced. The prediction is empirically distinguishable from RDT’s prediction, and it applies to a class of organizational phenomena platform ecosystems, open innovation communities, inter-organizational knowledge commons that RDT consistently struggles to explain.

5.4. Ecosystem and Platform Theory: From Architecture to Assemblage

Ecosystem and platform theories represent the most recent and in some respects the most sophisticated attempts to theorize organizational boundaries in conditions of complex interdependence (Jacobides et al., 2018; Adner, 2017). These frameworks acknowledge that value creation increasingly occurs across organizational boundaries, through complementary relationships among multiple actors, and that the governance of these relationships requires analytical tools that go beyond both TCE and RDT. In this respect, ecosystem theory moves in the same direction as the holobiont framework, and the dialogue between them is correspondingly more nuanced.

The critical difference lies in the treatment of organizational identity and the role of the platform owner or keystone firm. In ecosystem theory, the architecture of the ecosystem the division of roles between platform owners and complementors, the rules of participation, the mechanisms of value capture is defined and governed by a central actor whose identity, strategic intent, and architectural authority anchor the system. The ecosystem is, in this sense, a hierarchical structure wearing relational clothing: it acknowledges interdependence but organizes it around a stable center. The holobiont framework challenges precisely this residual centrism. In a holobiont organizational system, there is no stable center whose identity precedes and grounds the relational assemblage; there are only co-evolving actors whose identities emerge from and are sustained by the assemblage as a whole.

This distinction has practical consequences for how we theorize governance, competitive advantage, and resilience in complex organizational systems. Ecosystem theory predicts that system performance is primarily a function of the platform owner’s architectural choices and governance decisions. The holobiont framework predicts that system performance is primarily a function of the quality and depth of symbiotic relationships throughout the assemblage and that systems governed by constitutive symbiosis will exhibit forms of resilience and adaptive capacity that architecturally governed ecosystems cannot replicate, precisely because their adaptive capacity is distributed across the entire relational assemblage rather than concentrated in a central governance structure.

5.5. Limitations of the Holobiont Framework

Theoretical honesty requires us to acknowledge the limitations of the framework we have proposed. Five limitations are particularly significant and deserve explicit attention.

First, the holobiont framework is most directly applicable to organizational forms characterized by deep, persistent, and constitutive inter-organizational relationships meeting the three conditions identified in the illustrative cases section: temporal depth, mutual transformation, and distributed governance. It is less directly applicable to organizations that operate primarily through discrete transactional exchanges or within stable hierarchical governance structures, and it is not intended to apply to early-stage alliances or project-based collaborations that have not yet achieved constitutive depth. We do not claim that all organizations are or should be holobiont organizations; we claim that a theoretically significant and empirically growing class of organizational forms exhibits holobiont properties, and that existing theory cannot adequately explain these forms. The scope of the framework is therefore bounded by the three-condition specification above, and future empirical work should test and refine these criteria.

Second, the holobiont framework's emphasis on constitutive symbiosis and relational identity raises difficult questions about organizational agency and accountability. If organizational identity is relationally constituted and co-evolutionarily maintained, it becomes theoretically unclear how we should attribute strategic decisions, moral responsibility, and legal accountability within the relational assemblage. This is not merely a practical concern; it is a theoretical one with direct implications for how we conceptualize intentionality and governance in holobiont organizational forms. The biological holobiont provides no resolution here biological organisms do not face legal accountability which means that the theoretical transfer reaches a genuine limit at this point. Future theoretical work must develop an account of distributed agency adequate to holobiont organizational forms, drawing potentially on recent work in process ontology (Langley & Tsoukas, 2017) and relational agency (Emirbayer, 1997) to theorize how strategic intentionality can be distributed across a relational assemblage without being dissolved into it.

Third, the holobiont framework, by foregrounding the generative potential of symbiotic relationships, risks under-theorizing the pathological dimensions of inter-organizational symbiosis. Biological holobionts are not invariably benign: parasitic relationships, opportunistic colonization, and symbiotic dysbiosis the breakdown of previously generative microbiome relationships are central features of holobiont biology with direct organizational analogues. Organizations engaged in ostensibly symbiotic relationships may experience dependency lock-in, capability appropriation, or identity erosion dynamics that the present framework does not systematically address. A complete holobiont organizational theory must ac-

count for the conditions under which constitutive symbiosis turns pathological: when boundary permeability becomes exploitative rather than generative, when co-evolution produces asymmetric dependence rather than mutual capability development, and when relational identity coherence slides into loss of strategic autonomy. These are not merely edge cases; they are theoretically central to understanding the governance challenges facing holobiont organizational forms, and their neglect represents a significant gap in the framework as currently specified.

Fourth, the holobiont framework faces a non-trivial measurement challenge. Distinguishing constitutive symbiotic relationships from deep relational exchange i.e., from the most sophisticated forms of governance theorized by relational governance theory requires empirical criteria that the framework does not yet supply in operationalizable form. We have proposed three boundary conditions (temporal depth, mutual transformation, distributed governance), but each requires further specification: How many years constitute sufficient temporal depth? How much change in core capability profiles is required to demonstrate mutual transformation rather than peripheral learning? What governance mechanisms are sufficiently distributed to qualify as non-hierarchical? These are not merely measurement questions; they are theoretical questions about where constitutive symbiosis begins and deep relational exchange ends. Future work should develop and validate empirical instruments drawing on longitudinal network analysis, matched-pair capability assessments, and relational identity surveys capable of distinguishing holobiont organizational forms from their near neighbors.

Fifth, the biological foundations of our framework, while theoretically generative, carry the risk of what Tsoukas (1991) termed the "misplaced concreteness" of metaphorical reasoning the tendency to treat the structural features of the source domain as if they were literal properties of the target domain. We have been explicit throughout this paper that our theoretical transfer rests on structural homology rather than surface analogy, and that we do not claim organizations are holobionts in any literal sense. We have further specified the criterion for valid structural homology as the isomorphism of relational structures across domains, following Tsoukas (1991) and Morgan (1986). Nevertheless, the risk of misplaced concreteness is real and multi-directional: readers may import biological assumptions about fitness landscapes, selection pressures, or genetic transmission that the framework does not intend and that have no organizational analogue. We therefore recommend that subsequent applications of the holobiont framework be explicit about which biological mechanisms are being transferred and which are being deliberately set aside. The three mechanisms identified in this paper constitutive symbiosis, co-evolutionary boundary formation, and emergent identity are the load-bearing elements of the theoretical transfer. Other features of holobiont biology the genetic mechanisms

of horizontal gene transfer, the immunological specificity of host-microbiome recognition are not part of the organizational framework and should not be imported by analogy.

6. Discussion and Conclusion

6.1. Theoretical Contributions

This paper set out to address a specific and consequential gap in organizational theory: the inability of existing frameworks to theorize organizational boundaries as relational, permeable, and co-evolutionary phenomena rather than fixed, jurisdictional, and hierarchically enforced demarcations. We have argued that this gap reflects not a deficiency in any particular theory but a shared epistemological assumption what we termed the jurisdictional boundary assumption that runs through transaction cost economics, resource dependence theory, and ecosystem frameworks alike. And we have proposed that the holobiont concept from evolutionary biology offers the conceptual architecture needed to fill this gap, through a framework built on three formal propositions concerning boundary permeability as a generative property, symbiotic collaboration logic, and relational organizational identity.

The theoretical contributions of this paper are three. First, we reconceptualize organizational boundaries as generative rather than merely protective phenomena. The dominant tradition in organizational boundary theory treats permeability as a problem to be managed a source of vulnerability, dependence, and identity dilution that must be carefully calibrated against the benefits of external access. The holobiont framework inverts this logic, proposing that boundary permeability is the mechanism through which emergent organizational capabilities are produced under conditions of constitutive symbiosis. This reconceptualization does not render existing boundary theories obsolete; it identifies the conditions under which their logic applies and proposes a complementary framework for the conditions increasingly prevalent in contemporary organizational environments under which it does not.

Second, we introduce symbiotic collaboration logic as a theoretically distinct mode of inter-organizational relationship that existing frameworks cannot adequately capture. Transaction cost economics theorizes collaboration as transactional exchange between pre-constituted entities. Relational governance theory theorizes collaboration as trust-based exchange that reduces transaction costs while leaving organizational identities intact. Ecosystem theory theorizes collaboration as complementary role-filling within an architecturally governed value system. None of these frameworks theorizes the possibility that collaboration might be constitutive that organizations might become what they are through their symbiotic relationships rather than despite them. Symbiotic collaboration logic fills this theoretical space, proposing that the most consequential forms of inter-organizational competitive advantage emerge precisely from relationships that transform the collaborating organizations rather than merely connecting them.

Third, we develop a relational theory of organizational identity that challenges the stability and boundedness assumptions embedded in dominant identity frameworks. Albert and Whetten's (1985) conception of organizational identity as central, distinctive, and enduring has been enormously productive, but it rests on an ontological assumption that identity is a property of the bounded organization rather than of its relational context that the holobiont framework calls into question. We propose that in holobiont organizational forms, identity continuity is a function of relational pattern coherence rather than internal characteristic stability, generating a conception of organizational identity that can accommodate radical internal transformation while maintaining analytical coherence.

6.2. Implications for Future Research

The holobiont framework opens several productive directions for future empirical and theoretical research. We identify four that we consider most consequential. Table 2 presents the Holobiont organizational framework.

Table 2

Future research agenda for the holobiont organizational framework

Source: Author's own design.

Research direction	Key question	Suggested method	Related proposition
Identification of holobiont forms	What empirical criteria distinguish holobiont organizations from ecosystems and alliances?	Comparative case studies; longitudinal organizational analysis	Propositions 1, 2, 3

(continued on next page)

Table 2 (continued)

Research direction	Key question	Suggested method	Related proposition
Formation and dissolution dynamics	When and how do inter-organizational relationships become constitutive? What follows dissolution?	Process studies; historical analysis of inter-organizational relationships	Propositions 1, 2
Governance of holobiont systems	How are holobiont systems governed without a stable architectural center?	Ethnographic studies; OSS communities; research consortia	Proposition 2
Holobiont logic and sustainability	How does relational identity reshape corporate responsibility and ecological governance?	Mixed methods; stakeholder network analysis; longitudinal sustainability studies	Proposition 3

The first and most immediate concerns the empirical identification and characterization of holobiont organizational forms. Our framework proposes that a theoretically significant class of organizations exhibits holobiont properties constitutive boundary permeability, symbiotic collaboration logic, and relational identity but we have not specified the empirical conditions under which these properties are most likely to emerge. Future research should develop criteria for identifying holobiont organizations in practice, drawing on case study methodologies and comparative organizational analysis to map the range and diversity of holobiont organizational forms across industries, institutional environments, and historical periods.

The second direction concerns the dynamics of holobiont formation and dissolution. Biological holobionts are not formed instantaneously; they emerge through extended co-evolutionary processes in which host and symbiont gradually become constitutively interdependent. The organizational analogue of this process the transition from transactional or relational exchange to constitutive symbiosis is theoretically underspecified in our framework and represents a rich agenda for future theoretical and empirical work. When and how do inter-organizational relationships become constitutive? What organizational and environmental conditions facilitate or impede the emergence of symbiotic collaboration logic? What happens when holobiont organizational forms dissolve when constitutive symbiotic relationships are severed and how do the component organizations reconstitute their identities in the aftermath?

The third direction concerns the governance of holobiont organizational systems. Our critique of ecosystem theory's residual centrism raises an important practical question: if holobiont organizational systems are not governed by a

stable center, how are they governed? The holobiont framework suggests that governance in these systems is distributed, emergent, and co-evolutionary that it arises from the pattern of symbiotic relationships rather than from the architectural decisions of a central actor. But this is a theoretical claim that requires substantial empirical and theoretical development. Future research should examine the governance mechanisms of organizations that exhibit holobiont properties open source software communities, inter-organizational research consortia, platform ecosystems without dominant platform owners with the goal of developing a theory of distributed governance adequate to the complexity of holobiont organizational forms.

The fourth direction concerns the relationship between holobiont organizational logic and sustainability. The holobiont concept has deep connections to ecological thinking to the recognition that organisms are not isolated entities but participants in complex webs of interdependence whose health depends on the health of the whole. This ecological dimension of the holobiont framework has direct implications for organizational sustainability theory, suggesting that the most resilient and adaptive organizations are not those that most effectively defend their boundaries against environmental pressure but those that most deeply embed themselves in constitutive symbiotic relationships with their social and ecological environments. Future research should develop the connections between holobiont organizational theory and sustainability scholarship, exploring the implications of relational organizational identity for corporate social responsibility, stakeholder theory, and the governance of organizational impacts on ecological systems a direction that resonates with the growing body of work on sustainability, green innovation, and environmental governance (Yazıcı & Çiçeklioğlu, 2025;

Yazıcı et al., 2025).

7. Conclusion

We began this paper with a question that organizational theory has not adequately answered: where does one organization end and another begin? We end it with a different question one that the holobiont framework makes it possible to ask: how do organizations become what they are through the relational assemblages in which they participate? This is not merely a reframing of the original question; it is a reconceptualization of what organizational theory is trying to explain. The holobiont framework proposed in this paper does not offer a final answer to this reconceptualized question. It offers a theoretical starting point a set of concepts, mechanisms, and propositions that make the question answerable in ways that existing frameworks do not. The boundary of the organization, we have argued, is not a line to be drawn and defended but a relational achievement to be continuously produced through symbiotic engagement with the organizational environment. Organizational identity is not a stable property to be protected but an emergent outcome of co-evolutionary processes. And competitive advantage, in holobiont organizational forms, is not a possession of the bounded firm but a property of the relational assemblage as a whole.

These are strong theoretical claims, and they deserve the scrutiny of empirical investigation and theoretical critique. We offer them not as conclusions but as invitations to organizational scholars who study the boundaries of firms, the logic of collaboration, and the nature of organizational identity, and who find, as we have, that the most interesting phenomena in contemporary organizational life lie precisely at the edges of what existing theory can see. From hierarchy to holobiont: the journey is not from one organizational form to another but from one way of seeing organizations to another. And it begins, as all theoretical journeys do, with the willingness to ask a question that the existing map cannot answer.

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INTANGIBLE CULTURAL HERITAGE, LOCAL ENTREPRENEURSHIP, AND SUSTAINABLE TOURISM IN

Intangible cultural heritage, local entrepreneurship, and sustainable tourism in an insular context: The case of Madeira Wine Traditions

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ABSTRACT

Intangible cultural heritage (ICH) has increasingly been recognized as a strategic resource for sustainable tourism development, particularly in island territories where cultural identity and endogenous resources play a central role in territorial sustainability. This article examines the case of Madeira Wine Traditions within the context of the ongoing candidature to UNESCO's Representative List of the Intangible Cultural Heritage of Humanity, exploring how heritage safeguarding may contribute to tourism development, local entrepreneurship and community engagement. The study adopts a qualitative case study approach, combining documentary analysis, participant observation and semi-structured interviews with 49 representatives of Madeira wine-producing organizations and 24 wine growers. The empirical material was analyzed through thematic content analysis focusing on four dimensions: heritage safeguarding and cultural identity, community participation and territorial mobilization, tourism entrepreneurship, and linguistic proximity. The findings reveal broad stakeholder support for the safeguarding of Madeira Wine Traditions and highlight the UNESCO candidature as a mechanism for awareness-raising, institutional cooperation and community mobilization. The results also suggest that the valorization of this heritage may create opportunities for authentic wine tourism experiences while reinforcing cultural transmission through linguistic proximity. At the same time, challenges related to vineyard abandonment, demographic ageing and tourism pressures remain significant. The study demonstrates how intangible cultural heritage can support more sustainable tourism strategies in island destinations by strengthening cultural identity, community participation and local development.

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1. Introduction

The growing demand for more sustainable forms of tourism has increased interest in the role of culture as a driver of territorial development. Beyond its economic contribution, tourism is increasingly expected to support cultural preservation, strengthen community participation and contribute to the long-term sustainability of destinations. Within this context, intangible cultural heritage (ICH) has emerged as a strategic resource capable of enhancing the authenticity and distinctiveness of tourism experiences while reinforcing local identity and social cohesion. The UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage (2003) contributed to a broader understanding of heritage as a living expression of communities, encompassing knowledge, practices, skills, oral traditions and social rituals transmitted across generations. Recent studies suggest that the safeguarding of ICH can generate benefits that extend beyond cultural preservation, contributing to tourism diversification, local development and community resilience. These dynamics are particularly relevant in island territories, where geographical constraints and economic dependence on tourism often create challenges for sustainable development. At the same time, increasing attention has been given to the relationship between cultural heritage and entrepreneurship. Heritage-based tourism initiatives can create opportunities for local businesses while supporting the preservation of traditional practices and cultural landscapes. However, achieving this balance requires the active participation of local communities and governance models capable of integrating cultural, economic and social objectives.

Language also represents an important dimension of cultural heritage and tourism development. Linguistic proximity can facilitate communication, knowledge transmission and the interpretation of cultural practices, strengthening the relationship between heritage bearers, visitors and tourism markets. In Portuguese-speaking contexts, language may function not only as a communication tool but also as a cultural asset that contributes to identity formation and entrepreneurial initiatives associated with cultural tourism. The Autonomous Region of Madeira provides a particularly relevant setting for examining these relationships. Madeira Wine Traditions constitute one of the island's most distinctive cultural expressions, integrating centuries-old viticultural knowledge, production techniques, social practices and specialized vocabulary associated with wine production. Simultaneously, the sector faces important challenges, including vineyard abandonment, demographic ageing, labour shortages and increasing pressure from tourism and urban development. Against this background, the ongoing candidature of Madeira Wine Traditions to UNESCO's Representative List of the Intangible Cultural Heritage of Humanity offers a valuable opportunity to analyze how heritage safeguarding processes may contribute to

community mobilization, tourism entrepreneurship and sustainable territorial development.

The main objective of this article is to examine how the valorization of Madeira Wine Traditions as intangible cultural heritage may contribute to sustainable tourism development and local entrepreneurship in an island destination, while exploring the role of linguistic proximity in cultural transmission and tourism experiences. To achieve this objective, the study adopts a qualitative case study approach based on documentary analysis, participant observation and semi-structured interviews with representatives of wine-producing organizations and wine growers involved in the safeguarding process. The article is organized into six sections. Following this introduction, the literature review discusses the relationship between intangible cultural heritage, tourism, entrepreneurship and linguistic proximity. The subsequent sections present the case study, research methodology, empirical findings and conclusions.

2. Intangible Cultural Heritage, Language and Entrepreneurship in Sustainable Tourism

Sustainable tourism has been widely discussed in academic literature as a balance-oriented approach between economic growth, environmental protection, and socio-cultural equity (UNWTO, 2018). In this context, Higgins-Desbiolles (2018) argues that sustainable tourism must go beyond a strict environmental vision, integrating culture as a central element in the construction of resilient, inclusive and socially just destinations. This perspective underlines the need to incorporate cultural, identity and community values into tourism planning and development models. Thus, the importance of socio-cultural and economic factors in the development of sustainable tourism, points to a close relationship between intangible cultural heritage (ICH), language and cultural identity, and tourism entrepreneurship. These dimensions are often analyzed together because they contribute to the attractiveness of destinations, the innovation of tourism products and the generation of sustainable socio-economic benefits for host communities (Hall & Zeppel, 1992; Richards, 2018). The safeguarding of intangible cultural heritage — which includes cultural practices, oral traditions, festivals, linguistic expressions and community knowledge — has assumed increasing relevance in the context of sustainable tourism, being recognized as a valuable tourist resource, since it offers unique experiences that promote the authenticity and differentiation of destinations (UNESCO 2003; UNESCO, 2019; Timothy, 2020).

Lenzerini (2011) stresses that intangible cultural heritage should be understood as living culture, whose protection is inseparable from sustainable development and the dignity of the communities that practice it. In this sense, the integration of the ICP in tourism offers can strengthen the attractiveness of destinations, particularly when based on participatory man-

agement models and respect for local values (Kim et al., 2019). In the European context, Nunes (2024) empirically demonstrates that local identity and the preservation of the PCI positively influence the perception of tourism sustainability by residents and visitors, highlighting the role of language and regional cultural expressions as key factors in the sustainable enhancement of peripheral and island territories. However, the sustainable exploitation of this heritage requires not only its preservation, but also its integration into tourism development strategies capable of generating local entrepreneurial opportunities and strengthening the cultural and economic capacities of communities (Timothy, 2020). The literature also shows that intangible cultural heritage can function as a factor of competitive differentiation, attracting segments of tourists motivated by deep and significant cultural experiences (O’Leary et al., 1998; Richards, 2018; Smith & Robinson, 2006). This role of the PCI has been analyzed in the light of emerging trends in experiential and responsible tourism, in which the active participation of the visitor is particularly relevant.

However, several authors warn of the risks of excessive commodification and commodification of cultural practices when they are simplified or decontextualized for exclusively tourist purposes (Khaokhrueamuang & Chueamchaitrakun, 2019; Soini & Birkeland, 2014). The main challenge is thus to balance the protection of cultural authenticity with the need to make heritage accessible and intelligible to visitors, ensuring that the local community retains control over its cultural expressions (Uslu et al., 2024). In this context, Pine and Gilmore (2011) argue that immaterial cultural experiences, by involving active participation and emotional meaning, constitute central elements of the so-called “experience economy”. Cultural tourism thus ceases to assume a merely observational nature, becoming an interactive practice that promotes a greater connection between tourists and host communities, reinforcing the attractiveness of destinations that preserve and actively promote their ICP (Richards & Wilson, 2007).

Language, as a cultural heritage and shared identity element, also plays a strategic role in the dynamics of tourism, as illustrated by the case of the Community of Portuguese Speaking Countries (CPLP). In addition to being a means of communication, language is a cultural asset that influences mobility, social cohesion and the construction of transnational networks of tourism cooperation (Reto, 2012; Santos, 2019). In Portuguese-speaking contexts, linguistic proximity facilitates the creation of business networks, tourist flows and the circulation of knowledge, contributing to the dynamism of entrepreneurship in the sector (Esperança, 2010; Reto, 2012; Santos, 2019). The appreciation of the ICP as a market resource depends mostly on the ability of local entrepreneurs to communicate authentic cultural narratives, reconciling cultural value and economic return — a central tenet of sustainable tourism entrepreneurship (Freytag & Hjalager, 2021).

Empirical research reinforces that the articulation between intangible cultural heritage, entrepreneurship and language has positive impacts on local development and social inclusion.

The study by Gonçalves, Dorsch, and Figueiredo (2022) demonstrates that tourism projects that incorporate intangible traditions, local knowledge, and cultural narratives tend to generate higher levels of visitor satisfaction and greater retention of value in host communities. This is particularly visible in initiatives associated with traditional festivities, typical gastronomy and handicrafts, elements that, when communicated and experienced in Portuguese, reinforce the sense of authenticity and belonging, both for Portuguese-speaking and non-Portuguese-speaking visitors. Additionally, studies carried out in Portuguese-speaking countries show that the language can function as an instrument of territorial branding, facilitating access to regional and international tourist markets and enhancing the creation of business partnerships, with positive effects on cultural entrepreneurship and the development of local micro-enterprises (Schneider et al., 2021).

In the light of this framework, the case of the Madeira Wine Traditions is a particularly expressive example of how intangible cultural heritage can be mobilized as a strategic resource for the development of sustainable tourism and local entrepreneurship in island contexts. Madeira’s traditional winemaking practices integrate a complex set of technical knowledge, linguistic expressions, productive rituals and forms of social organization transmitted intergenerationally, which constitute a privileged basis for the creation of authentic and differentiating tourist experiences, in line with the dynamics of experiential tourism (Pine & Gilmore, 2011; Richards & Wilson, 2007). The enhancement of this heritage, when articulated with small-scale entrepreneurial initiatives and participatory management models, has the potential to strengthen the competitiveness of the destination, promote the retention of value in wine communities and diversify the tourist offer beyond conventional products (Richards, 2018; Timothy, 2020). In this process, linguistic proximity, namely in the Portuguese-speaking space and with the Madeiran diaspora, emerges as a facilitating factor for communication, cultural interpretation and the construction of territorial narratives capable of sustaining entrepreneurial projects based on wine and culture. The following section empirically analyses the application process of Madeira Wine Traditions to UNESCO’s Representative List of the Intangible Cultural Heritage of Humanity, exploring how these theoretical principles materialize in a concrete context of heritage enhancement, tourism entrepreneurship and territorial sustainability.

3. The Traditions of Madeira Wine and the Sustainability of the Destination — An Articulation Between Intangible Cultural Heritage, Language and Entrepreneurship

Following the theoretical framework presented in the previous section, this section focuses on the analysis of the case of Madeira Wine Traditions as a manifestation of intangible cultural heritage with strategic relevance for the development of sustainable tourism and local entrepreneurship in an island territory. Island regions face specific challenges in terms of sustainable development, associated with their peripheral location, small territorial scale, limited resources and high environmental vulnerability (Baldacchino, 2006; Sharpley, 2009). In this context, Madeira Wine plays a central role in the historical, cultural and economic identity of the Autonomous Region of Madeira, constituting both a symbol of international recognition and an endogenous resource with potential for the diversification of the tourist offer and for the economic enhancement of the territory (Silva, 2023).

Madeira Wine is produced exclusively in the Demarcated Region of Madeira, is distinguished by its organoleptic characteristics and specific winemaking and ageing techniques, developed over several centuries (Liddel, 2014; Pereira, 1989). Despite its international reputation, viticulture in Madeira has been in sharp decline. Currently, the vineyard area represents only a fraction of what existed in the mid-twentieth century, making this one of the smallest wine regions in Portugal (Pereira, 1989). This process raises significant concerns regarding the preservation of the agricultural landscape, intangible cultural heritage and territorial and tourist sustainability. The Madeira Region (RAM) represents 801.10 km of land surface and is in the North Atlantic Ocean (Regional Directorate of Statistics). According to the same source, the territory is an archipelago of eight islands, two of which — Madeira (736 km²) and Porto Santo (43 km²) — are inhabited. The rest include three islands called Desertas (14 km²) and three islands called Selvagens (4 km²).

Madeira has a heavy dependence on the tourism sector, supported by factors such as its strategic geographical location on the Atlantic, its mild climate throughout the year, stunning landscapes, and a rich cultural and gastronomic offer (Majdack et al., 2022). According to Madeira's "Tourism Satellite Account" (Regional Directorate of Statistics, 2019), tourism in Madeira contributes about 28.8% of the region's Gross Domestic Product (GDP), reflecting a greater importance than the national average in Portugal, which does not exceed 15.3%. Thus, the tourism sector represents one of the main pillars of the economy of the Autonomous Region of Madeira, acting as a driving force for economic development and job creation. There are studies that show that wine tourism is a relevant strategy to promote sustainability in island destinations, such as the Autonomous Region of Madeira, by diversifying the tourist offer, reducing seasonality and valuing endogenous resources (Getz & Brown, 2006). It also contributes to job creation, the settlement of the population in rural areas, the preservation of the landscape and the strengthening of cultural identity (Abreu et al., 2019; Crespi-Vallbona &

Mascarilla-Miró, 2021).

In this sense, wine tourism emerges as a strategic solution to enhance the value of Madeira Wine, reinforce the attractiveness of the destination and create incentives to maintain the viticultural activity (Abreu et al., 2019; Breda et al., 2020). This perspective is aligned with regional tourism strategies and the Sustainable Development Goals, which recognize the role of intangible cultural heritage in promoting sustainable and inclusive development (Regional Government, 2021; Karampela et al., 2016). However, the current decline in viticulture, combined with tourist and demographic pressure, puts at risk the traditions of Madeira Wine and the sustainability of the destination (Pereira, 1989; Deller, 2010). Among the main current challenges are the aging of the agricultural population, the lack of attractiveness of viticulture for the younger generations, and the fragmentation of agricultural plots, which hinders mechanization and increases production costs (Pereira, 1989; Abreu et al., 2019). Urban and tourist pressure, particularly intense on the south coast of the island, has contributed to the conversion of agricultural land into tourist and residential developments, a phenomenon already identified in the literature as one of the main risks to the sustainability of rural tourism (Deller, 2010; Connell & Page, 2006). This process compromises the continuity of the winemaking activity and the preservation of the cultural landscape that sustains the attractiveness of the Madeira destination.

The application to UNESCO's Intangible Cultural Heritage thus asserts itself as a strategic instrument for safeguarding, institutional mobilization and strengthening collective awareness around the practices, knowledge and values that structure this heritage. In conjunction with this dimension, the preservation of the intangible cultural heritage associated with Madeira Wine may create conditions for wine growers to benefit more directly from tourism activity and concrete incentives for the continuity of their agricultural practice. The unique characteristics of a heroic viticulture, deeply rooted in the territory and in the know-how passed down between generations, make the family farms of the Region particularly attractive to visitors, giving them a high degree of authenticity. In this context, linguistic proximity plays a central role, by facilitating communication between producers, tourists and markets, promoting a relationship of trust, knowledge sharing and cultural appreciation that favors more immersive tourist experiences. This proximity, combined with local entrepreneurship, can stimulate the development of innovative initiatives that reconcile grape production with tourist activities, such as interpretive visits, small-scale wine tourism or personalized cultural experiences. This combination would not only increase the profitability of wine activity, but also make it more attractive to new generations, reinforcing the economic, social and cultural sustainability of Madeira's wine-growing communities.

4. The Application Process of Madeira Wine Traditions to UNESCO's Intangible Cultural Heritage as an Instrument of Safeguarding and Territorial Mobilization (Ongoing)

4.1. Research Design and Methodological Approach

This research adopts a qualitative case study design, an approach considered particularly suitable for the in-depth investigation of contemporary social phenomena within their real-life context. The case study methodology is especially relevant when the boundaries between the phenomenon under analysis and the context in which it occurs are not clear, requiring the integration of multiple sources of evidence and different forms of empirical observation. In the present study, the case selected is the ongoing candidature of Madeira Wine Traditions to UNESCO's Representative List of the Intangible Cultural Heritage of Humanity. The choice of this case is justified by its strategic relevance for understanding the relationships between intangible cultural heritage, sustainable tourism, local entrepreneurship, linguistic proximity, and territorial sustainability in an island context. Madeira Wine Traditions constitute a complex socio-cultural phenomenon involving agricultural practices, technical knowledge, oral traditions, linguistic expressions, social rituals, economic activities, and community identity processes developed over several centuries. Simultaneously, the candidature process itself represents a unique opportunity to observe how different stakeholders mobilize around a shared heritage resource and how safeguarding initiatives may generate opportunities for tourism development and entrepreneurship.

The study follows an interpretivist perspective, seeking to understand the meanings attributed by different actors to Madeira Wine Traditions and to the safeguarding process associated with the UNESCO candidature. Rather than testing predetermined hypotheses, the research aims to explore perceptions, experiences, expectations, and forms of participation among stakeholders involved in the wine sector and in the candidature process. Although additional interviews were conducted with institutional representatives and experts during the preparation of the candidature dossier, the present article focuses exclusively on the perceptions of wine growers and wine-producing organizations, as these stakeholder groups are directly involved in the preservation and transmission of Madeira Wine Traditions.

4.2. Data Collection Procedures

The empirical material analyzed in this study was collected during the preparation of the candidature dossier and combines multiple qualitative sources of evidence. This strategy was adopted to ensure a comprehensive understanding of the phenomenon under investigation and to strengthen the cred-

ibility of the findings through methodological triangulation. The first source of information consisted of documentary analysis. A systematic review was conducted of historical studies, legislative documents, official reports, UNESCO guidelines, institutional publications, archival records, press articles, academic literature, and technical documentation related to Madeira Wine and to the safeguarding of intangible cultural heritage. Documentary evidence was particularly important for reconstructing the historical evolution of Madeira Wine Traditions and identifying their cultural, social, and economic significance within the regional context. A second source of evidence resulted from extensive fieldwork carried out during the preparation of the candidature. The fieldwork involved direct observation of meetings, awareness-raising initiatives, public presentations, institutional contacts, and community engagement activities promoted by the Working Group responsible for the candidature. This participant observation component allowed the researchers to document interactions between stakeholders, understand decision-making processes, and identify emerging concerns regarding heritage preservation, tourism development, and community participation.

The third and most significant source of empirical data consisted of semi-structured interviews, that were conducted and recorded in audio format, with stakeholders representing segments of the Madeira Wine sector. Among all, for purpose of the present study the results of the interviews with 24 wine growers and 49 representatives of wine-producing companies will be presented and discussed. The interviewees were selected through purposive sampling. This sampling strategy was considered appropriate because the objective was not statistical representativeness but rather the inclusion of participants possessing relevant knowledge and experience regarding the phenomenon under study. Selection criteria included involvement in wine production activities, participation in safeguarding initiatives, institutional responsibilities related to culture or tourism, and recognized expertise concerning Madeira Wine Traditions. The sample included actors from different geographical areas of the island and different levels of involvement in the candidature process. This diversity contributed to the collection of a broad range of perspectives and reduced the risk of overrepresentation of interests or viewpoints.

4.3. Interview Structure and Data Recording

Semi-structured interviews were selected because they allow a balance between consistency and flexibility. While maintaining a common analytical framework across interviews, this format also enables the exploration of issues that emerge spontaneously during conversations and allows participants to express their views in their own terms. The interview protocol included questions organized around several thematic dimensions. These dimensions comprised the cultural significance of Madeira Wine Traditions, perceived threats to their

continuity, safeguarding needs, relationships between heritage and local identity, opportunities for tourism development, entrepreneurial potential associated with wine tourism, community participation, and the expected impacts of UNESCO recognition. In addition, specific questions were included concerning the contribution of Madeira Wine Traditions to the achievement of the United Nations Sustainable Development Goals and regarding the criteria established by UNESCO for inscription on the Representative List of the Intangible Cultural Heritage of Humanity. Although a common interview structure was maintained, questions were adapted according to the profile of each participant. Wine growers were invited to discuss production practices, intergenerational knowledge transmission, and current challenges affecting viticulture. Representatives of wine companies were questioned about commercial perspectives, tourism opportunities, and safeguarding strategies. All interviews were recorded with the consent of participants and subsequently transcribed for analytical purposes. Detailed notes were also taken during and immediately after interviews to register contextual observations, non-verbal information, and preliminary analytical reflections.

4.4. Data Analysis and Coding Procedures

The empirical material was analyzed using thematic content analysis, following the procedures proposed by Braun and Clarke (2006). This analytical approach was selected because it provides a systematic framework for identifying, organizing, and interpreting patterns of meaning within qualitative data. The analysis was conducted through several stages. Initially, all interview transcripts, documentary materials, and field notes were reviewed repeatedly to ensure familiarity with the data. During this phase, preliminary observations and analytical memos were produced. Subsequently, an initial coding process was undertaken. Coding combined deductive and inductive procedures. Deductive codes were derived from the theoretical framework developed in the literature review, particularly concepts related to intangible cultural heritage, sustainable tourism, entrepreneurship, linguistic proximity, territorial sustainability, and community participation. Inductive coding allowed the identification of themes that emerged directly from participants' narratives and were not anticipated by the theoretical framework.

The coded material was then organized into broader thematic categories. Through iterative comparison and refinement, recurring patterns were identified and grouped into higher-order analytical themes. The resulting thematic structure highlighted four major dimensions:

- Heritage safeguarding and cultural identity;
- Community participation and territorial mobilization;
- Tourism entrepreneurship and economic opportunities;
- Linguistic proximity and cultural transmission.

These themes emerged consistently across different categories

of stakeholders and constitute the analytical framework underpinning the discussion presented in this article.

The coding process was conducted recursively, involving multiple rounds of review and refinement. Documentary evidence and observational data were continuously compared with interview findings to verify consistency and identify convergences and divergences between different sources.

4.5. Reliability, Validity and Trustworthiness

Several procedures were adopted to strengthen the reliability and trustworthiness of the research. First, methodological triangulation was achieved through the combination of documentary analysis, participant observation, and semi-structured interviews. The convergence of evidence from different sources enhanced the robustness of interpretations and reduced the risk of relying excessively on a single source of information. Second, data source triangulation was ensured through the inclusion of participants representing different sectors, institutional positions, and levels of involvement in Madeira Wine Traditions. This diversity contributed to a more comprehensive understanding of the phenomenon and allowed the identification of recurring patterns across stakeholder groups. Third, analytical triangulation was promoted through the continuous comparison between empirical findings and the theoretical concepts discussed in the literature review. This process facilitated the interpretation of results within broader debates concerning intangible cultural heritage, sustainable tourism, and entrepreneurship. Fourth, prolonged engagement in the field contributed significantly to contextual understanding. The preparation of the candidature involved sustained interaction with stakeholders over an extended period, allowing the researchers to gain familiarity with the social, cultural, and institutional dynamics surrounding Madeira Wine Traditions. Finally, all participants were informed of the objectives of the research and the candidature process before their participation. The study respected principles of voluntary participation, informed consent, transparency, and ethical management of qualitative data. Interviewees were informed that the information collected could be used both in the candidature dossier and in scientific publications related to the safeguarding of Madeira Wine Traditions.

4.6. Empirical Context of the UNESCO Candidature Process

Within the scope of the requirements required for possible inscription on the Representative List of the Intangible Cultural Heritage of Humanity, the Working Group responsible for the ongoing application, coordinated by an expert (A.J.M.S.), began the process with the preparation of a formal request for the inscription of the winemaking traditions of the Autonomous Region of Madeira in the National Inventory of Intangible Cultural Heritage (PCI).

5. Results and Discussion

5.1. Overview of the Empirical Findings

This section presents the empirical findings derived from the qualitative case study, focusing on the perceptions of stakeholders involved in the UNESCO application process for Madeira Wine Traditions. The data, collected through semi-structured interviews with 49 management positions across all eight Madeira wine-producing organizations, illuminate how the theoretical principles of intangible cultural heritage (ICH), local entrepreneurship, and sustainable tourism materialize in this specific insular context. The analysis is structured around key themes identified from the interviews, providing a comprehensive understanding of the initiative’s perceived impacts and challenges. Additionally, the analysis of 24 semi-structured interviews with wine growers across various localities in Madeira Island, including Câmara de Lobos,

Calheta, Santana, São Vicente, and Funchal will be also presented. These testimonials, collected during the 2024 harvest, provide a grassroots perspective on the UNESCO application process and the socio-economic reality of the wine sector.

5.2. Perceptions of Madeira Wine-Producing Organizations

The analysis of interviews of Madeira wine-producing organizations revealed a strong consensus regarding the strategic importance of UNESCO recognition for Madeira Wine Traditions. The perceptions gathered align with the overarching goal of leveraging ICH for sustainable development, as discussed in the theoretical framework. The following table summarizes the main themes, principal evidence, the number of interviewees who referenced each theme, and illustrative literal quotes.

Table 1
Perceptions of Madeira wine-producing organizations.
Source: Own Elaboration.

Theme	Main Evidence	No. of interviewees who mentioned the theme	Quotes
Heritage Safeguarding	Preservation of viticultural knowledge and practices	49 (100%)	<i>“I think that this application can bring transmission to people of what is still possible to do in Madeira wine. Or even recover history. We have a long history. (...) and if we look at it, the practices, that is, the difficulties in working the vineyards today, are not that different from what they were 200 and 300 years ago. This is true. And this is something that I think people usually call heroic viticulture”</i> (Ricardo de Freitas - administrator/ general manager and winemaker of Vinhos Barbeito company). <i>“I think that the application is undoubtedly one of the most important tools for making people truly aware of the value of wine and creating a cultural and emotional bond with it”</i> (Francisco de Albuquerque – production manager and winemaker of Madeira Wine Company). <i>“It’s not just alcoholic beverage, it’s all history that will still come with the wine (...) there are several centuries of history that, if we don’t value, in the future we will only value the past”</i> (Melissa de Castro – commercial and tourism manager of H. M. Borges company).

(continued on next page)

Table 1 (continued)

Theme	Main Evidence	No. of interviewees who mentioned the theme	Quotes
Community Mobilization	Participation of associations and institutions	25 (50%)	<i>“There must be a working team, both between the various wine producers and with the Regional Government, so that we can work together in a concerted effort for the good of farmers and also Madeira wine”</i> (Susana Pedro – financial manager of Funchal Agrarian Cooperative – brand Madeira Vintners). <i>“And I think this is a lesson for all of us, for us, for those who live here to really know and realize this and not forget something that was unique”</i> (Gabriela Afonso – commercial manager of Funchal Agrarian Cooperative – brand Madeira Vintners).
Tourism Entrepreneurship	New wine tourism experiences	37 (75%)	<i>“This application not only honors the past, but it’s a strategic path to build the future of wine and tourism in the region”</i> (Mariana Pinto – commercial and marketing manager of Vinhos Barbeito company). <i>“Madeira wine is regaining the status it had in the past... But it is possible to create this new attention, and, for that, it is necessary to have vineyards, because vineyards really beautify our landscape. Coexistence is possible”</i> (Juan Teixeira – administrator/ general manager, production and tourism manager of Justino’s company).
Linguistic Proximity	Communication with visitors and diaspora	43 (88%)	<i>“In my reality, they [foreigners] know Madeira wine better than we Madeirans, we are Portuguese. It’s a fact”</i> (Graça Gouveia – commercial manager of Henriques & Henriques company). <i>“I think it will only benefit... extend our entire history for the next generations in the four corners of the world”</i> (Ana Soares – Lodges Museum and guides manager of Madeira wine Company). <i>“It is also important because of our interpreters, of the whole process involved, and it is good to give knowledge of the whole process that is done”</i> (André Miranda - production manager and winemaker of Henriques & Henriques company).

5.2.1. Heritage Safeguarding

The theme of Heritage Safeguarding emerged as a paramount concern, with all 49 interviewees (100%) emphasizing the importance of preserving traditional viticultural knowledge and practices. This finding strongly resonates with Len-

zerini’s (2011) perspective on ICH as a living culture, inseparable from sustainable development. The concept of “heroic viticulture,” as articulated by Ricardo de Freitas, highlights the arduous yet culturally significant methods of wine production in Madeira, underscoring a deep-seated desire to transmit this historical legacy to future generations. Francisco de Albu-

querque's quote further reinforces the role of the UNESCO application as a tool to foster awareness and an emotional bond with the wine's value, aligning with the idea of ICH as a differentiating resource that contributes to authenticity (UNESCO, 2003; Timothy, 2020). Melissa de Castro's statement about valuing centuries of history to avoid losing the past encapsulates the urgency felt by stakeholders to protect this heritage from potential erosion.

5.2.2. Community Mobilization

Community Mobilization was identified as a crucial aspect, with 50% of interviewees (approximately 25 individuals) highlighting the participation of associations and institutions, and 75% emphasizing local pride. Susana Pedro's call for a "working team" between wine producers and the Regional Government for the "good of farmers and also Madeira wine" illustrates the perceived need for collaborative governance and stakeholder engagement, echoing the participatory management models discussed by Kim et al. (2019). Gabriela Afonso's reflection on the initiative being a "lesson for all of us, for us, for those who live here to really know and realize this and not forget something that was unique" points to the internal mobilization and reinforcement of local identity that the UNESCO application process can engender. This aligns with the article's premise that ICH enhancement, when articulated with participatory models, strengthens the cultural and economic capacities of communities.

5.2.3. Tourism Entrepreneurship

Regarding Tourism Entrepreneurship, 75% of interviewees (approximately 37 individuals) saw the UNESCO application to foster new wine tourism experiences and improve tourism quality. Mariana Pinto's assertion that the application is a "strategic path to build the future of wine and tourism in the region" directly supports the article's argument that ICH can be mobilized as a strategic resource for sustainable tourism development and local entrepreneurship. The existing context of "visits to wine cellars, wine tastings, and festivals dedicated to viticulture" already being valuable tourist experiences, as mentioned in Section 2 of the original article, provides a foundation upon which new entrepreneurial initiatives can be built. Juan Teixeira's perspective on Madeira wine "regaining the status it had in the past" through new attention and the necessity of vineyards to "beautify our landscape" suggests a vision for integrated tourism development that values both the product and its cultural landscape, contributing to the diversification of the tourist offer beyond conventional products (Richards, 2018; Timothy, 2020).

5.2.4. Linguistic Proximity

Linguistic Proximity emerged as a significant facilitating factor, with 88% of interviewees (approximately 43 individuals) recognizing its role in communication with visitors and the diaspora. Graça Gouveia's candid observation that "foreigners know Madeira wine better than we Madeirans, we Portuguese" underscores the global reach and recognition of Madeira wine, and implicitly, the importance of effective communication with international audiences. Ana Soares's vision of extending "our entire history for the next generations in the four corners of the world" highlights the potential of linguistic connections to reach the Madeiran diaspora and broader Portuguese-speaking communities, fostering a sense of shared heritage and promoting the wine globally. André Miranda's emphasis on the role of "interpreters" and the importance of conveying "knowledge of the whole process that is done" further illustrates how linguistic proximity facilitates cultural interpretation and the construction of authentic territorial narratives, which are crucial for sustaining entrepreneurial projects based on wine and culture, as discussed by Esperança (2010) and Santos (2019).

An important distinction emerged between linguistic proximity and cultural identity. While cultural identity refers to the collective sense of belonging associated with Madeira Wine Traditions, including shared memories, values, practices and historical experiences, linguistic proximity operates as a mechanism that facilitates the transmission, interpretation and communication of that identity. The interviews suggest that language contributes to preserving specialized viticultural knowledge, conveying cultural meanings to visitors and strengthening connections with the Madeiran diaspora and Portuguese-speaking markets. In this sense, linguistic proximity should not be understood as a component of cultural identity itself, but rather as a facilitating factor that supports the safeguarding, dissemination and valorization of intangible cultural heritage.

5.3. Wine Growers Perceptions and UNESCO Recognition

This section presents the findings from the content analysis of interviews conducted with 24 viticulturists in Madeira, focusing on the four primary themes: Heritage Safeguarding, Community Mobilization, Tourism Entrepreneurship, and Linguistic Proximity. The analysis aims to identify patterns, challenges, and perspectives among the viticulturists, providing a foundation for discussing the sustainability and future of viticulture in the region. Table 2 summarizes the main themes identified in the interviews, the primary evidence, the percentage of interviewees who mentioned each theme, and representative quotes.

Table 2

Perceptions of the wine growers.

Source: Own Elaboration.

Theme	Main Evidence	No. of interviewees who mentioned the theme (%)	Quotes
Heritage safeguarding	Mentioned by 12 viticulturists.	50.0%	“We are preparing a candidacy to inscribe Madeira Wine on the List of Intangible Cultural Heritage of Humanity.” Several interviewees support the candidacy of Madeira Wine for Intangible Cultural Heritage of Humanity and mention the importance of preserving traditional savoir-faire.
Community mobilisation	Mentioned by 13 viticulturists.	54.2%	“They help each other out!” Mutual aid among family members, friends, and neighbours is crucial to mitigating labour shortages...
Tourism entrepreneurship	Mentioned by 10 viticulturists.	41.7%	Pressure from tourism and the construction industry leads to the abandonment of vineyards and their replacement with more profitable crops such as bananas. “The banana tree, once confined to the seaside, now debuts at altitudes where it was never seen before...”
Linguistic Proximity	Mentioned by 13 viticulturists.	54.2%	“espolda... pruning, tying.” Specific terms like ‘mangra’ (powdery mildew) or ‘espolda’ (pruning) demonstrate the richness of the technical lexicon and generational nuances...

5.3.1. Heritage Safeguarding

Approximately half of the interviewed viticulturists (50.0%) expressed support for the candidacy of Madeira Wine for Intangible Cultural Heritage of Humanity. This data highlights the awareness and value that producers place on preserving traditions and the savoir-faire associated with viticulture in the region. The quotes reveal that the candidacy is seen as an opportunity to raise awareness about the hard work and culture behind Madeira Wine, which is often unknown to the final consumer. The valuation of intangible heritage can thus serve as an incentive for younger generations, although its effectiveness in reversing the abandonment of the activity is questioned by some interviewees.

5.3.2. Community Mobilization

Community mobilization is a fundamental pillar for the sustainability of viticulture in Madeira, with 54.2% of inter-

viewees mentioning the importance of mutual aid. Labour shortages are a significant challenge, and solidarity among family members, friends, and neighbors is crucial for performing tasks such as the harvest. This practice of “helping each other out” demonstrates the resilience and social cohesion of viticultural communities, where collective work compensates for the lack of human and financial resources. However, reliance on this informal mobilization raises questions about its long-term sustainability, especially in the face of an ageing population and declining interest from younger generations.

5.3.3. Tourism Entrepreneurship

The theme of tourism entrepreneurship and its influence on viticulture was mentioned by 41.7% of the viticulturists. The interviews reveal a tension between tourism growth and the maintenance of viticultural activity. Real estate pressure and the expansion of more profitable crops, such as the banana tree, lead to the abandonment of vineyards, particularly

on more accessible land. While tourism is an economic driver for the region, its uncontrolled expansion could threaten the cultural landscape and the very existence of traditional viticulture. The need to find a balance between tourism development and the preservation of agricultural activity is a pressing challenge.

5.3.4. Linguistic Proximity

Linguistic proximity, manifested through the technical lexicon and expressions used by the viticulturists, was a relevant theme for 54.2% of the interviewees. The use of specific terms such as “mangra” (powdery mildew) or “espolda” (pruning) reflects the cultural richness and historical depth of Madeiran viticulture. Generational differences in terminology are also notable, with older practitioners employing traditional terms and younger ones adopting more technical language. This linguistic richness is an indicator of cultural identity and knowledge transmitted from generation to generation, but it also points to the need to document and preserve this lexicon before it is lost with the decline of the activity and the ageing of its practitioners. In summary, the analysis of the interviews reveals a resilient viticultural community, deeply connected to its traditions and mutual aid, but facing significant challenges related to labour shortages, pressure from tourism development, and the need for generational renewal. The candidacy for Intangible Cultural Heritage of Humanity is seen as an opportunity to value and protect this heritage, but its effectiveness will depend on support policies that ensure the economic and social viability of viticulture in Madeira. The findings indicate that cultural identity and linguistic proximity perform complementary but analytically distinct functions within the safeguarding of Madeira Wine Traditions. Whereas cultural identity provides the symbolic foundation that gives meaning to the heritage, linguistic proximity facilitates its transmission across generations, communities and tourism markets, thereby enhancing its potential contribution to sustainable tourism and heritage-based entrepreneurship.

6. Conclusion

This article examined how intangible cultural heritage (ICH) can function as a strategic resource for sustainable tourism development and local entrepreneurship in island territories, using the ongoing UNESCO candidature of Madeira Wine Traditions as a qualitative case study. Building upon the literature on heritage tourism, cultural entrepreneurship, linguistic proximity, and destination sustainability, the study sought to understand how heritage safeguarding processes may simultaneously reinforce cultural identity, stimulate community participation, and create opportunities for economic diversification. The empirical findings confirm that Madeira Wine Traditions constitute far more than a productive activity

or a commercial asset; they represent a living cultural system integrating agricultural knowledge, technical practices, oral traditions, and social rituals transmitted across generations. The data collected from both wine-producing organizations and wine growers reveal a strong consensus on the strategic importance of UNESCO recognition. While organizations focus on the global positioning and the “heroic” nature of viticulture, wine growers highlight the critical role of community mobilization and mutual aid (mentioned by 54.2% of growers) as essential pillars for overcoming labour shortages and ensuring the sustainability of the sector.

Furthermore, the study underscores the role of linguistic proximity as a facilitating factor for cultural interpretation and territorial narratives. The specific lexicon shared by viticulturists, such as “mangra” or “espolda”, serves as a marker of identity and a tool for authentic communication with visitors and the diaspora. However, the analysis also exposes significant challenges, particularly the tension between tourism expansion and the maintenance of traditional vineyards. The pressure from more profitable crops like bananas and the real estate sector (noted by 41.7% of growers) poses a real threat to the cultural landscape. From a policy perspective, the results reinforce the need for integrated strategies that connect heritage safeguarding with tourism planning and entrepreneurship support. Public policies must recognize ICH not only as a cultural asset but as a driver of innovation and community resilience. Strengthening the economic viability of small-scale viticulture through wine tourism and heritage valorization is essential to ensure that the “Madeira Wine Traditions” remain a living heritage rather than a museum piece.

Despite the depth of the qualitative analysis, this study is subject to certain limitations. As a case study focused specifically on the island of Madeira during an active UNESCO application process, the findings reflect a unique socio-political and geographical context that may not be directly generalizable to other wine-producing regions or non-insular territories. Furthermore, the qualitative nature of the interviews provides rich subjective insights but lacks the longitudinal data necessary to measure the long-term socio-economic impacts of heritage recognition after its eventual implementation. In conclusion, the valorization of intangible cultural heritage, when combined with community participation and entrepreneurial initiatives, contributes significantly to the sustainability of tourism destinations. The case of Madeira Wine Traditions illustrates how heritage safeguarding can evolve beyond preservation objectives to become a dynamic instrument for cultural continuity and sustainable development in island regions.

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CORRECTIVE DIGITAL INTERMEDIATION IN TOURISM ECOSYSTEMS: A CONCEPTUAL FRAMEWORK FOR THE GROWTH OF AIR PASSENGER RIGHTS PLATFORMS BEYOND DYNAMIC PACKAGING

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ABSTRACT

The digital transformation of tourism has been predominantly theorised through the lenses of online distribution, dynamic packaging and platform-mediated consumption, all of which concentrate analytical attention on the pre-travel phase of search, comparison, assembly and purchase. This paper addresses a parallel and under-theorised phenomenon: the rapid expansion of digital platforms whose value proposition activates only after the travel product has been bought and only when its delivery fails. Firms such as AirHelp, Flightright and AirAdvisor are frequently and imprecisely folded into narratives of tourism digitalisation, yet their growth cannot be explained by dynamic packaging or by any extension of distribution innovation. We argue that these firms constitute a distinct organisational form, which we term the corrective digital intermediary (CDI), and we develop a conceptual framework that locates this form outside the traditional tourism value chain. The framework decomposes the conditions that generate CDIs into four interacting layers (structural volatility, regulatory entitlement, an enforcement gap and platform scalability) and theorises their interaction through a sequence of testable propositions and hypotheses. We further offer an integrative review of four adjacent literatures (tourism distribution, air-transport economics, passenger-rights regulation and platform theory) and synthesise from it a four-type taxonomy of digital intermediaries distinguished by their temporal locus and their relationship to service performance. The framework reframes platform diversity in tourism ecosystems, clarifies why corrective platforms scale where individual enforcement fails, and yields implications for tourism governance, airline strategy and regulatory design. By separating pre-travel optimisation from post-travel correction, the paper contributes a more differentiated account of digital intermediation and platform-based entrepreneurship, identifying a distinct, regulation-driven category of digital venture and setting an agenda for its empirical examination.

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1. Introduction

The study of digital transformation in tourism has matured around a relatively stable explanatory core. Successive waves of research have traced how information technology displaced traditional travel agencies, how online travel agencies (OTAs) and meta-search engines re-intermediated the market, and how dynamic packaging allowed travellers to assemble bespoke combinations of transport, accommodation and ancillary services in real time (O'Connor, 2023; Lv et al., 2020). Almost without exception, this literature is organised around a single temporal locus: the moment before travel, in which demand is generated, products are compared and transactions are completed. The dominant questions concern search costs, price transparency, personalisation, algorithmic ranking and the strategic dependence of suppliers on platform gatekeepers (Stangl et al., 2016; Lei et al., 2019).

Running alongside this well-charted trajectory, however, is a phenomenon that the prevailing frameworks struggle to accommodate. Over the past fifteen years, a category of digital firms has grown rapidly whose entire reason for existing is that the purchased travel product sometimes fails. Companies such as AirHelp, Flightright, AirAdvisor and ClaimCompass do not sell flights, do not assemble packages and do not compete for the traveller's attention at the point of purchase. They become relevant only when a flight is delayed, cancelled or oversold, and their service consists of converting a passenger's latent legal entitlement into an enforced monetary outcome. These firms are routinely described, in trade commentary and even in some scholarship, as part of the broader story of tourism digitalisation. That description is intuitive but, we argue, conceptually mistaken.

The central claim of this paper is that the growth of air passenger rights platforms cannot be explained by dynamic packaging or by any other innovation in tourism distribution. Dynamic packaging and CDIs respond to different problems, occupy different phases of the consumption cycle, draw on different underlying assets and create value through different mechanisms. Treating them as variants of the same digital-distribution trend obscures what is genuinely novel about the corrective platform and impoverishes our understanding of platform diversity in tourism ecosystems.

To substantiate this claim we pursue three connected objectives. First, we conduct an integrative review across four adjacent but rarely combined literatures (tourism distribution, air-transport economics, passenger-rights regulation and platform theory) in order to identify the explanatory gap that corrective platforms occupy. Second, we develop an original conceptual framework that defines the corrective digital intermediary as a distinct organisational form and specifies the four-layer mechanism that brings it into being. Third, we translate the framework into a set of formal propositions and testable hypotheses, and we derive from the review a four-type

taxonomy that situates corrective intermediation relative to the more familiar species of digital intermediary.

The contribution is deliberately conceptual rather than empirical. Our purpose is not to measure the market or to test the propositions with data, but to supply the theoretical scaffolding that such measurement would require. In doing so we follow the conventions of conceptual and theory-building work in tourism and management research, where the value of a paper lies in the clarity of its constructs, the coherence of its relationships and the productiveness of the research agenda it opens (Jaakkola, 2020; MacInnis, 2011). Conceptual papers of this kind do not derive their authority from sample size or statistical inference; they earn it by defining constructs sharply enough that they can later be measured, by specifying relationships precisely enough that they can later be falsified, and by organising disparate evidence into a structure that reveals what previous accounts have missed. The present paper aspires to all three: it names a construct that the literature has gestured at but never defined, it states the relationships among its antecedents in a form that admits empirical refutation, and it synthesises four separate bodies of scholarship into a single explanatory architecture.

A further methodological point deserves emphasis at the outset. The choice of an integrative review, rather than a systematic or bibliometric one, follows directly from the nature of the problem. A systematic review presupposes a bounded field with an established set of questions and methods; it is the right instrument for consolidating what is known within a mature literature. The phenomenon studied here, by contrast, falls between fields, and its very invisibility is a product of disciplinary fragmentation. An integrative review is the appropriate response because its purpose is precisely to combine perspectives from distinct literatures and to generate, rather than merely summarise, theory (Snyder, 2019; Torraco, 2005). The four literatures we draw upon were selected not because they overlap but because each contributes one necessary premise to an argument none of them completes alone. To ensure currency, the synthesis was cross-checked against recent AI-assisted evidence syntheses of each literature, which confirmed that the most recent scholarship continues to treat distribution, disruption, regulation and platform governance in isolation rather than as a single explanatory chain.

This reframing matters for the study of digital innovation and entrepreneurship, not only for tourism distribution. Corrective digital intermediaries are, in entrepreneurial terms, a new venture type: firms that discover and exploit an opportunity created not by unmet consumer desire but by institutional failure, building scalable digital businesses on the gap between a legal right and its realisation. Understanding how such ventures emerge, why they scale and where their opportunity space comes from speaks directly to research on digital entrepreneurship, platform business models and technology-enabled service innovation. The framework developed here

therefore contributes to the broader entrepreneurial-research agenda by identifying a distinct, regulation-driven category of digital venture and specifying the conditions under which it becomes viable.

The remainder of the paper is organised as follows. Section 2 sets out the methodological approach and reviews the four literatures, isolating the explanatory gap. Section 3 presents the conceptual framework and its four constitutive layers. Section 4 develops the propositions and hypotheses. Section 5 sets out the taxonomy of digital intermediaries. Section 6 discusses theoretical, managerial and policy implications. Section 7 acknowledges limitations and sketches an agenda for empirical work, and Section 8 concludes.

2. Theoretical Background and Methodological Approach

2.1. Methodological Approach

This study adopts a conceptual, theory-building design rather than an empirical one. Following established guidance on conceptual contributions (Jaakkola, 2020; MacInnis, 2011), the paper combines two of Jaakkola's templates: theory synthesis, which integrates evidence from several literatures into a coherent account, and typology, which organises a phenomenon into a structured classification. The synthesis is grounded in an integrative literature review, the appropriate method when the goal is to combine perspectives from distinct fields and generate new theory rather than to summarise a mature one (Snyder, 2019; Torraco, 2005). Four bodies of scholarship were purposively selected because each supplies one necessary premise of the argument: tourism distribution, air-transport economics, passenger-rights regulation and platform theory. Sources were identified through database searching and citation chaining, prioritising recent peer-reviewed work, and were synthesised thematically around the conditions that give rise to corrective platforms. To ensure currency, the synthesis was cross-checked against recent AI-assisted evidence syntheses of each literature, which confirmed that the most recent scholarship continues to treat these domains in isolation rather than as a single explanatory chain. The output of this process is the framework, propositions and taxonomy developed in Sections 3 to 5.

An integrative review is appropriate where the aim is not to catalogue a settled field but to bring together fragments from several fields in order to generate a new conceptualisation (Snyder, 2019; Torraco, 2005). The phenomenon of corrective intermediation sits at the intersection of four literatures that have developed largely in isolation from one another. Reviewing them together reveals a recurring blind spot: each illuminates part of the conditions that produce corrective platforms, yet none accounts for the platform form itself.

2.2. Tourism Distribution and the Pre-Travel Bias

Tourism distribution research has long been organised around the function of intermediation, that is, the reduction of information asymmetry, the aggregation of fragmented supply and the facilitation of transactions between producers and consumers (O'Connor, 2023). The diffusion of digital technologies was first interpreted as a threat of disintermediation, as suppliers gained direct access to consumers; subsequent evidence showed instead a process of re-intermediation, in which platform actors such as OTAs and meta-search engines came to dominate the distribution landscape by centralising demand, exploiting network effects and coordinating supply through data (Kim & Cho, 2024; Nazmabadi, 2025). These actors reconfigured the balance of power within tourism value chains, gaining control over visibility, price comparison and consumer attention, and shaping supplier strategies around availability and brand positioning (Stangl et al., 2016; Lei et al., 2019).

Dynamic packaging is the apex of this trajectory. Rather than offering pre-defined bundles, dynamic packaging systems allow consumers to assemble personalised combinations of components in real time, enabled by semantic interoperability, application programming interfaces and inventory synchronisation (Agarwal et al., 2013; Reino et al., 2016; Lv et al., 2020). Recent work frames these web APIs as the structuring infrastructure of the entire online-travel ecosystem, enabling decentralised co-production and rapid reconfiguration of service networks without supplier lock-in (Pujadas et al., 2024). Artificial intelligence has deepened the model through personalised recommendation, demand prediction and dynamic pricing (Lim & Kim, 2025; Zhu et al., 2023), and the model aligns economically with the broader unbundling of services in air transport, where airlines have progressively separated core and ancillary products and transferred assembly decisions to consumers (Granados et al., 2012). The distribution literature has itself begun to map the appearance of new agents and intermediation roles within this ecosystem (Fernández-Villarán & Cuenca, 2023; Kim & Cho, 2024), yet these accounts remain firmly anchored in the pre-purchase phase of search, bundling and booking.

For all its sophistication, this literature exhibits a consistent pre-travel bias. Dynamic packaging, OTAs and AI-driven recommendation systems are concerned almost exclusively with optimising decision-making and transaction efficiency before consumption begins. Implicit in the entire apparatus is the assumption that, once a product is purchased, delivery will occur as expected. The literature therefore explains how travellers assemble and buy journeys, but it has nothing to say about what happens, or what institutions arise, when the journey fails.

This bias is reinforced, not corrected, by the parallel literature on generational change in travel behaviour. Research on

younger cohorts, Millennials and Generation Z, documents a strong orientation toward autonomy, flexibility, continuous connectivity and real-time control over itineraries, expectations that distribution platforms have rushed to satisfy (Amaro & Duarte, 2015; Foroughi et al., 2025). Social media, user-generated content and peer review embed travel decisions within everyday digital practice and push distribution systems toward non-linear, iterative purchase journeys (Varkaris & Neuhofer, 2017; Chen, 2025). The growth of remote and hybrid work has further expanded the temporal and spatial reach of travel and intensified demand for modular, customisable products. Yet this entire stream of work concerns empowerment before travel. The same digitally fluent traveller who assembles a complex itinerary with ease is, the evidence shows, no more competent at navigating a compensation claim when the itinerary collapses. Digital empowerment in the pre-travel phase coexists with digital disempowerment during service failure, a paradox the distribution literature notes in passing but never theorises, because its analytical gaze does not extend past the point of sale.

2.3. Air-Transport Economics and Structural Volatility

The air-transport economics literature supplies precisely the missing premise. Two decades of liberalisation, intensified competition and efficiency-oriented business models have produced carriers that operate with high aircraft utilisation, dense scheduling, complex network architectures and extensive outsourcing of ground services. These strategies improve cost efficiency but simultaneously erode operational slack and system resilience. Tightly coupled systems of this kind are inherently vulnerable to cascading failure: a localised disturbance, whether weather, crew shortage or a technical fault, can propagate rapidly across a network and generate widespread delay and cancellation (Granados et al., 2012). A growing body of network-science research formalises this intuition, showing how disruptions diffuse nonlinearly through interdependent airports and flights and how recovery depends on network topology (Li et al., 2022; Wandelt et al., 2025). Indeed, recent work reframes flight cancellations not as isolated incidents but as indicators of a nonlinear operational transition that occurs once system stress exceeds adaptive capacity (Momtaz, 2026), while empirical studies of extreme weather demonstrate the scale at which delay and cancellation propagate across national networks (Bombelli & Sallan, 2023). Climate change compounds the problem by raising the frequency of extreme weather events that disrupt operations and airport capacity (Horne et al., 2023).

The systemic implication is that contemporary air transport has become a high-efficiency, low-resilience system in which reliability is structurally difficult to guarantee. Service failure is not an aberration to be designed away but a recurrent, statistically predictable feature of the system. This is the

supply-side condition that creates a continuous stream of disrupted passengers, and therefore a continuous flow of potential claims. Yet the air-transport literature treats disruption mainly as an operational and welfare problem; it does not theorise the market institutions that form to process the claims disruption generates.

The same literature, viewed through the lens of the travel experience, also clarifies why disruption matters disproportionately. The travel experience is conventionally modelled as a sequence of touchpoints across pre-travel, during-travel and post-travel phases. Distribution technologies optimise the first; disruption strikes the second, when the traveller is most exposed and least able to act. Service failures in air transport have an outsized effect on satisfaction, trust and loyalty relative to failures in other tourism components, and they generate secondary losses, such as missed connections, additional accommodation, lost working days and emotional strain, that often exceed the direct cost of the disrupted flight (Varkaris & Neuhofer, 2017). For travellers who combine work and leisure, whose tolerance for delay is low because delay interferes with professional obligations, the welfare loss is sharper still. From the passenger's standpoint, disruption is a moment of acute vulnerability marked by uncertainty, limited control and a pronounced asymmetry of information and expertise in the airline's favour. The air-transport literature describes this vulnerability vividly; what it does not do is connect it to the institutional response it provokes.

2.4. Passenger-Rights Regulation and the Enforcement Gap

The regulatory literature describes the entitlement side of the equation. European Union Regulation 261/2004 is among the most comprehensive passenger-protection regimes in the world, formalising rights to assistance and compensation in cases of denied boarding, long delay and cancellation, and seeking to rebalance power between airlines and passengers by internalising part of the cost of service failure. Successful judicial interpretations, particularly around the contested notion of “extraordinary circumstances,” have extended the scope of compensation but also multiplied legal complexity.

Crucially, scholarship and policy evaluation converge on a gap between formal entitlement and practical realisation. Airlines routinely contest claims, shift the burden of proof onto passengers and prolong resolution, exploiting the persistent ambiguity of the “extraordinary circumstances” defence that recent legal scholarship identifies as the central source of uncertainty in the regime (Pazos, 2021; Drake, 2020). Behavioural and technology-acceptance research shows that, even when consumers are aware of their rights, perceived complexity and low self-efficacy sharply reduce the likelihood that they act (Ramayah et al., 2013; Vijayasarathy, 2004). Cross-border travel adds linguistic, jurisdictional and procedural barriers, and

national enforcement bodies apply the rules unevenly across Member States (Drake, 2020). The consequence is an enforcement gap: a large proportion of eligible passengers never claim, and the costs of disruption are silently externalised from carriers back to consumers. The regulation thus functions as latent protection: robust in principle, weak in individual-level implementation, a diagnosis that has prompted explicit calls to rethink the regulation itself (Brecke, 2025). The regulatory literature names this gap but stops short of explaining the firms that monetise its closure.

2.5. Platform Theory and the Form of Intermediation

Platform theory supplies the final piece: a vocabulary for the organisational form. Digital platforms are commonly theorised as multi-sided structures that create value by lowering transaction and coordination costs between distinct groups, by accumulating and exploiting data, and by exhibiting scale economies and network effects (Münter, 2025; Reino et al., 2016). A growing strand emphasises that such platforms are not passive conduits but active market-makers that structure triangular contractual relationships and shape outcomes through algorithmic governance (Gleiss et al., 2023), to the point that some are best understood as “false intermediary platforms” bearing responsibility for the transactions they orchestrate (Gastaminza, 2025). Most applications in tourism describe transaction platforms that match supply and demand before consumption. Platform theory more broadly, however, also encompasses intermediaries that aggregate dispersed and individually low-value claims, standardise their assessment and pursue them at scale, a logic now visible in legal-technology and claims-aggregation markets and in emerging accounts of automating consumer-rights enforcement (Samek, 2025). This is the conceptual resource that allows corrective intermediation to be specified, but it has not previously been con-

nected to the tourism and air-transport conditions described above.

Two features of platform economics are especially pertinent. The first is the role of marginal cost. A platform’s competitive advantage in claims processing rests on driving the marginal cost of handling one additional claim toward zero through automation, so that a portfolio of individually unremunerative cases becomes collectively profitable. The second is the role of the contingent-fee or no-win-no-fee contract, which transfers risk from the consumer to the platform and thereby dissolves the principal behavioural barrier, namely the consumer’s reluctance to invest effort and money in an uncertain outcome. Platform theory thus explains not only that aggregation is possible but why a particular contractual and cost structure makes it commercially compelling. What platform theory does not supply, on its own, is the demand-side story: it can describe how a corrective platform works once it exists, but not why the conditions for its existence arise. That story comes from the other three literatures, and joining them is the analytical work the next section performs.

2.6. The Explanatory Gap

Read together, the four literatures describe the necessary conditions for corrective platforms without ever naming the platform itself. Air-transport economics explains why disruption is endemic. Regulation explains why disruption generates entitlements. Behavioural and regulatory scholarship explains why those entitlements go largely unclaimed. Platform theory explains how dispersed claims can be aggregated and processed at scale. What no single literature provides is an account that joins these strands into a coherent explanation of a new organisational form positioned after purchase and outside the distribution chain. Filling that gap is the task of the framework developed next.

Table 1
The four contributing literatures and the explanatory gap.

Literature	What it explains	What it omits
Tourism distribution	How journeys are assembled and purchased; pre-travel optimisation	Anything occurring after purchase or after service failure
Air-transport economics	Why disruption is endemic in low-resilience systems	The market institutions that process disruption claims

(continued on next page)

Table 1 (continued)

Literature	What it explains	What it omits
Passenger-rights regulation	Why disruption creates legal entitlements; the enforcement gap	The firms that monetise closure of the gap
Platform theory	How dispersed claims can be aggregated at scale	The specific post-purchase, extra-chain positioning

3. Conceptual Framework: The Corrective Digital Intermediary

3.1. Defining the Construct

We define a corrective digital intermediary (CDI) as a digital platform whose value proposition is activated only by the failure of a previously purchased service, and which creates value by converting a consumer's latent legal or contractual entitlement into an enforced outcome at scale. Three elements distinguish the construct. First, temporal locus: the CDI operates after purchase and during or after consumption, not before. Second, conditional activation: its service has zero relevance when delivery succeeds and becomes valuable only upon failure. Third, corrective rather than allocative function: it does not allocate or assemble products but repairs the consequences of defective allocation, redistributing value from the underperforming supplier back to the consumer.

The CDI is therefore not a distribution intermediary in any conventional sense. A distribution intermediary stands between supply and demand to facilitate exchange; a corrective intermediary stands between a consumer and a non-performing supplier to enforce a remedy. The two are orthogonal: a market could in principle have rich distribution intermediation and no corrective intermediation, or vice versa. Recognising this orthogonality is the conceptual move that separates the growth of AirHelp from the growth of dynamic packaging.

It is worth dwelling on each of the three defining elements, because together they generate the framework's predictions. The temporal locus inverts the usual direction of intermediary attention. Distribution intermediaries compete for the consumer at the front of the journey, when many alternatives are live and switching is costless; corrective intermediaries meet the consumer at the back, when the transaction is complete, the alternatives are foreclosed and the only remaining decision is whether and how to seek redress. Conditional activation means the corrective intermediary's addressable demand is not the population of travellers but the much smaller population of travellers whose service has failed and who hold an unreal-

ised entitlement, a demand that is invisible to, and uncorrelated with, the demand that distribution platforms cultivate. The corrective rather than allocative function means the value the platform creates is redistributive: it does not enlarge the pie by improving matching but reallocates a slice of it from a supplier that has underperformed back to the consumer the supplier has failed. These three properties are not incidental descriptors; they are the premises from which the framework's propositions follow.

3.2. The Four-Layer Generative Mechanism

We theorise the emergence and growth of CDIs as the product of four interacting layers. Each layer is individually insufficient; the CDI form emerges only when all four are jointly present, and the rate of CDI growth is governed by their interaction.

3.2.1. Layer 1: Structural volatility

The first layer is a supply system that produces service failure at a predictable, non-trivial rate. In air transport this is the high-efficiency, low-resilience configuration described in Section 2.2: dense scheduling and minimal slack guarantee a steady flow of delays and cancellations (Granados et al., 2012; Horne et al., 2023). Structural volatility supplies the raw material of corrective intermediation: a continuous population of failure events. Where a supply system is highly resilient and failures are rare, the raw material is insufficient to sustain a corrective platform, regardless of the other layers.

3.2.2. Layer 2: Regulatory entitlement

The second layer is an institutional rule that attaches a transferable, monetisable entitlement to the failure event. EU Regulation 261/2004 is the paradigmatic case: it converts a delay or cancellation from a mere inconvenience into a defined legal claim with a monetary value. Without such an entitlement, a failure event generates dissatisfaction but no enforceable asset for a platform to pursue. The entitlement is what makes the

failure tradable. The clarity, scope and monetary level of the entitlement directly condition the attractiveness of the corrective market, and judicial extension of the regime's extraterritorial reach to third-country carriers has progressively widened the pool of monetisable claims (Satayanurug, 2025).

3.2.3. Layer 3: The Enforcement Gap

The third layer is the wedge between formal entitlement and actual enforcement. As Section 2.3 establishes, most eligible passengers never claim, deterred by complexity, low self-efficacy, supplier resistance and cross-border friction (Ramayah et al., 2013; Vijayasathy, 2004). The enforcement gap is the decisive layer: it is simultaneously the social problem the CDI addresses and the economic space it occupies. A wide gap means a large stock of unclaimed entitlements and a high willingness among consumers to delegate enforcement in exchange for a contingent fee. Paradoxically, the CDI's commercial opportunity is largest precisely where the regulation is least effective at the individual level.

3.2.4. Layer 4: Platform Scalability

The fourth layer is the technical and organisational capacity to process individually low-value, high-volume claims at near-zero marginal cost. This is the platform contribution: automated eligibility assessment against flight databases, standardised claim generation, mass submission, and the internalisation of legal and procedural complexity, increasingly supported by rule-based and machine-learning systems for claim justification and verification and by hybrid models that pair automation with human review of complex cases (Samek, 2025). Offered under a no-win-no-fee model that removes the consumer's up-front risk, this capability transforms a fragmented mass of trivial individual claims, each too small to justify private legal action, into an aggregated portfolio that is commercially viable. It is the mechanism that turns the latent demand created by Layers 1–3 into a realised market.

3.3. Interaction and the Multiplicative Logic

The four layers do not combine additively but multiplicatively. If any layer approaches zero, the realised size of the corrective market approaches zero, irrespective of the others. A highly volatile system with no regulatory entitlement (Layer 2 absent) produces angry passengers but no tradable claims. A generous entitlement that is trivially easy to enforce (Layer 3 absent) leaves no gap for an intermediary to occupy, because passengers simply claim for themselves. A wide enforcement gap with no scalable technology (Layer 4 absent) leaves the claims uncollected, as the pre-platform status quo demonstrated. We therefore express the latent magnitude of the corrective market as a conceptual product:

$$M_k \approx V \times R \times G \times S$$

where M_k is the latent corrective-market magnitude, V indexes structural volatility (the rate of failure events), R indexes the strength and monetary value of the regulatory entitlement, G indexes the width of the enforcement gap, and S indexes platform scalability. The multiplicative form captures the central theoretical intuition that the four layers are jointly necessary and individually insufficient, and that corrective intermediation is a genuinely emergent property of their interaction rather than the extension of any one of them. This logic deliberately mirrors, in a different domain, the recognition in capacity research that effective outcomes emerge from the interaction of several dimensions rather than from any single parameter (cf. Cifuentes, 1992).

3.4. Positioning Outside the Tourism Value Chain

A defining feature of the CDI is that it sits outside the traditional tourism value chain. The classical chain runs from suppliers through distribution intermediaries to the consumer and terminates at the point of consumption. The CDI attaches not to this forward flow of products but to a reverse flow of remedies that opens only when consumption is defective. It has no contractual relationship with the supplier it acts against, depends on no inventory and competes for none of the attention that OTAs and packaging platforms fight over. Its counterpart is not a competing distributor but the non-performing supplier and, behind it, the regulatory regime. This extra-chain positioning is why corrective growth is decoupled from distribution growth: the two respond to different signals and can move independently.

3.5. Visual Summary of the Framework

The framework can be summarised as a layered, conditional pipeline. Structural volatility (Layer 1) generates a stream of failure events; regulatory entitlement (Layer 2) attaches a tradable claim to each event; the enforcement gap (Layer 3) determines how many of those claims remain unclaimed and thus available; and platform scalability (Layer 4) determines how efficiently the available claims are converted into enforced outcomes. The realised corrective market is the throughput that survives all four gates. Figure 1 below illustrates this pipeline and the multiplicative logic that governs it. Table 2 expresses the same structure in propositional form, mapping each layer to its function, its absence-condition and its empirical proxy.

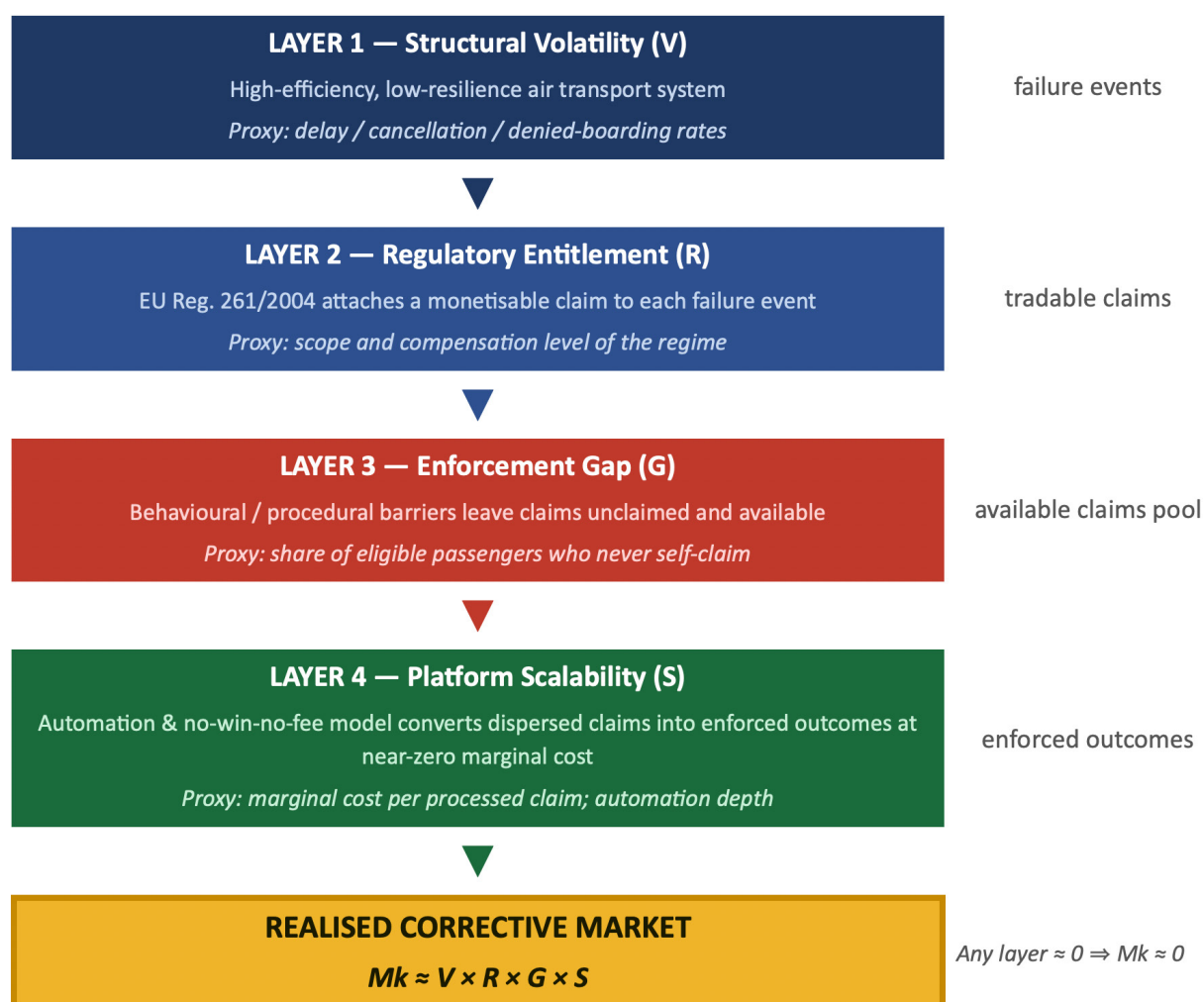


Figure 1: The four-layer conditional pipeline of corrective digital intermediation.

Note: The four layers are conjunctively necessary. The absence of any single layer is sufficient to prevent CDI emergence, regardless of the strength of the others.

Table 2

The four-layer generative mechanism of corrective digital intermediation.

Layer	Function in the mechanism	If absent	Indicative empirical proxy
1. Structural volatility (V)	Generates the stream of service-failure events	No raw material for claims	Delay / cancellation / denied-boarding rates
2. Regulatory entitlement (R)	Attaches a tradable, monetisable claim to each failure	Dissatisfaction but no enforceable asset	Scope and compensation level of the regime
3. Enforcement gap (G)	Leaves entitlements unclaimed and thus available	Consumers self-enforce; no space for intermediary	Share of eligible passengers who never claim
4. Platform scalability (S)	Converts dispersed claims into enforced outcomes at scale	Claims remain uncollected (pre-platform status quo)	Marginal cost per processed claim; automation depth

4. Theoretical Development: Propositions and Hypotheses

The framework yields a structured set of theoretical claims. We state the broad, relational claims as propositions (P) intended for conceptual elaboration, and the narrower, directly measurable claims as hypotheses (H) intended for empirical testing. The propositions articulate the framework's core logic; the hypotheses operationalise selected relationships for future quantitative work.

4.1. Core Propositions

Proposition 1 (Distinct domain). The growth of air passenger rights platforms is independent of innovation in tourism distribution; corrective intermediation and distribution intermediation respond to different signals and can grow at different, uncorrelated rates.

Proposition 2 (Conjunctive emergence). Corrective digital intermediaries emerge only when structural volatility, regulatory entitlement, an enforcement gap and platform scalability are jointly present; the absence of any single layer is sufficient to prevent emergence.

Proposition 3 (Multiplicative magnitude). The latent magnitude of a corrective market is multiplicative rather than additive in the four layers, such that the marginal effect of strengthening one layer increases with the strength of the others.

Proposition 4 (Enforcement-gap dependence). The commercial opportunity available to a corrective intermediary is increasing in the width of the enforcement gap; corrective platforms therefore thrive where individual-level regulatory enforcement is weakest.

Proposition 5 (Extra-chain positioning). Because the corrective intermediary operates outside the tourism value chain and without a contractual link to the supplier it acts against, its strategic constraints and competitive dynamics differ qualitatively from those of distribution intermediaries.

Proposition 6 (Regulatory reflexivity). Changes that narrow the enforcement gap by simplifying direct claiming, for example automated airline-initiated compensation, reduce the addressable market of corrective intermediaries, creating a reflexive tension between regulatory success and platform viability.

4.2. Testable Hypotheses

The following hypotheses translate the propositions into relationships amenable to empirical examination using route-level, carrier-level or jurisdiction-level data.

H1. Across jurisdictions, the volume of third-party compensation claims is positively associated with the strength and monetary level of the applicable passenger-rights regime (oper-

ationalising Layer 2 / R).

H2. Controlling for traffic volume, corrective-platform claim volumes are positively associated with carrier or route disruption rates (operationalising Layer 1 / V).

H3. The market penetration of corrective platforms is positively associated with measures of the enforcement gap, such as the proportion of eligible passengers who do not self-claim (operationalising Layer 3 / G).

H4. The growth rate of corrective-platform activity is statistically independent of the growth rate of dynamic-packaging and OTA activity within the same market and period (testing Proposition 1).

H5. The interaction term between disruption rate and regulatory strength explains variance in claim volume beyond their additive contributions, consistent with a multiplicative rather than additive specification (testing Proposition 3).

H6. Regulatory or technological interventions that lower the cost of direct self-claiming are followed by a decline in the addressable market and growth rate of corrective platforms (testing Proposition 6).

4.3. A Nomological Sketch

Taken together, the propositions and hypotheses form a nomological network in which the four layers act as antecedents, the latent corrective-market magnitude acts as the focal construct, and observable platform outcomes (claim volume, market penetration and growth rate) act as consequents. Proposition 1 and H4 establish discriminant validity against the distribution-innovation account; Propositions 2–3 and H5 specify the functional form of the antecedent–construct relationship; Proposition 4 and H3 isolate the enforcement gap as the pivotal antecedent; and Proposition 6 and H6 introduce a dynamic, reflexive boundary condition. This structure is intended to be falsifiable: a finding that corrective and distribution growth are strongly correlated, or that an additive specification fits better than a multiplicative one, would count as evidence against the framework.

Two methodological cautions attend this network and are worth stating so that future tests are interpreted correctly. First, several of the antecedents are difficult to observe directly and must be approached through proxies, such as disruption rates for volatility, regime characteristics for entitlement and non-claiming shares for the enforcement gap, each of which carries measurement error that will tend to attenuate estimated relationships; a failure to find an effect should therefore be read cautiously rather than as decisive refutation. Second, the layers are not fully independent of one another in practice. A regulator that strengthens entitlement (Layer 2) may simultaneously act to narrow the enforcement gap (Layer 3), inducing a negative empirical correlation between two layers that the framework treats as conceptually distinct. Careful design, exploiting jurisdictions or periods in which the layers move

separately, is therefore essential to identify the multiplicative interaction the framework predicts. These cautions do not weaken the network; they specify the conditions under which it can be fairly tested.

5. Results of the Synthesis: A Taxonomy of Digital Intermediaries

The framework implies that the familiar category of “digital

intermediary” conflates organisational forms that differ along two fundamental dimensions. The first dimension is temporal locus: whether the intermediary acts before or after the moment of consumption. The second is the relationship to service performance: whether the intermediary’s value depends on successful delivery or, conversely, is activated by failure. Crossing these two dimensions yields a four-cell taxonomy that locates corrective intermediation precisely and distinguishes it from its neighbours.

Table 3

A two-dimensional taxonomy of digital intermediaries in tourism ecosystems.

	Value depends on successful delivery	Value activated by service failure
Pre-consumption (before purchase / travel)	Type I: Allocative intermediaries: OTAs, meta-search, dynamic-packaging platforms; assemble and sell journeys	Type II: Protective intermediaries: travel-insurance and pre-purchase guarantee platforms; price the risk of failure in advance
Post-consumption (during / after travel)	Type III: Experiential intermediaries: review, reputation and loyalty platforms; capture value from successful experiences	Type IV: Corrective intermediaries (CDIs): air passenger rights platforms; enforce remedies when delivery fails

5.1. The Four Types

Type I, **allocative intermediaries**, are the subject of almost all existing tourism-distribution research. They operate before purchase and create value precisely when delivery is expected to succeed; their entire apparatus of search, comparison and assembly presupposes a functioning supply chain. OTAs, meta-search engines and dynamic-packaging platforms belong here (Lv et al., 2020; Agarwal et al., 2013).

Type II, **protective intermediaries**, also act before consumption but, unlike allocative intermediaries, derive value from the possibility of failure. Travel insurance and pre-purchase guarantee products price disruption risk in advance and pay out when it materialises. They share the failure-orientation of corrective intermediaries but differ in temporal locus: the consumer engages them prospectively, before knowing whether failure will occur.

Type III, **experiential intermediaries**, operate after consumption but capture value from success rather than failure. Review platforms, reputation systems and loyalty schemes monetise the traces of completed, broadly satisfactory experiences. They occupy the same post-consumption phase as corrective intermediaries but are mirror images in performance-orientation.

Type IV, **corrective intermediaries**, complete the matrix. They are the only type that combines a post-consumption

temporal locus with a failure-activated value proposition. This unique combination is what makes them analytically distinct and what explains why they cannot be assimilated to the Type I distribution platforms with which they are commonly confused. The taxonomy thus does more than classify: it demonstrates, by construction, that corrective intermediation occupies a cell that distribution theory has left empty.

5.2. Boundary Conditions and Hybrids

Real firms may occupy more than one cell or migrate between them. An OTA that bundles a disruption-compensation service is combining Type I and Type IV functions; an insurer that automates post-failure claim handling is bridging Types II and IV. The taxonomy is not a claim that firms are pure types but an analytical device for identifying the functions a firm performs and the distinct logics each function obeys. Hybridity, far from undermining the scheme, is most usefully described as the deliberate combination of analytically separable cells, and the strategic tensions of hybrid firms (for instance, an OTA enforcing claims against carriers on which it also depends for inventory) become visible only once the cells are distinguished.

6. Discussion and Implications

6.1. Theoretical Implications

The framework makes three theoretical contributions. First, it introduces the corrective digital intermediary as a distinct construct and supplies the criteria (post-purchase locus, conditional activation, corrective function and extra-chain positioning) that separate it from the allocative intermediaries that dominate the literature. Second, it specifies a generative mechanism in which four layers combine multiplicatively, offering a falsifiable functional form rather than a loose list of contributing factors. Third, by deriving a two-dimensional taxonomy, it reframes the entire category of digital intermediation in tourism, revealing that existing theory has populated only one of four cells and largely ignored the others.

More broadly, the paper contributes to platform theory by identifying a class of platforms whose distinctive property is conditional, failure-activated value. Most platform scholarship theorises value creation under successful matching; corrective platforms invert this, creating value only when prior matching has failed. This inversion suggests that platform theory itself may benefit from a temporal and performance-conditional refinement of the kind the taxonomy provides.

6.2. Managerial Implications

For corrective platforms, the framework clarifies the strategic terrain. Because their addressable market is the product of four layers, their growth depends on factors largely outside their control, namely disruption rates and regulatory design, and on one factor squarely within it: scalability. Competitive advantage therefore concentrates on automation depth, data access to flight records, breadth of jurisdictional coverage and the credibility of the no-win-no-fee promise. Proposition 6 warns these firms of a structural vulnerability: their market shrinks precisely to the extent that regulation succeeds in making self-claiming easy, so durable strategy must anticipate diversification beyond any single regime.

For airlines and traditional tourism distributors, the framework reframes corrective platforms not as competitors but as a recurring, externally imposed cost of unreliable delivery. Carriers can reduce that cost in two ways: by lowering structural volatility, which is operationally hard, or by narrowing the enforcement gap through proactive, automated compensation, which removes the intermediary's margin. For OTAs and packaging platforms contemplating hybrid corrective services, the taxonomy exposes the conflict of interest inherent in enforcing claims against suppliers on which they also depend.

The framework also clarifies a strategic asymmetry that is easily overlooked. Distribution platforms and corrective platforms compete for entirely different scarce resources. The binding constraint for an OTA is consumer attention and supplier

inventory at the front of the journey; the binding constraint for a corrective platform is data access, automation depth and jurisdictional reach at the back of it. Because these constraints do not overlap, the two forms can coexist indefinitely without direct rivalry, and a firm attempting to span both must manage two unrelated capability stacks rather than extend a single one. This is a further reason to resist the common framing of corrective platforms as a natural "next step" for distribution incumbents: the step is lateral, not forward, and it lands the firm in a market whose success conditions it does not already control. Managers who internalise the four-layer logic will evaluate entry into corrective intermediation by asking not whether they have distribution strength but whether the four layers are jointly present in the markets they would serve.

6.3. Policy Implications

For regulators the framework carries a pointed and somewhat uncomfortable message. The very existence of a thriving corrective-intermediation market is evidence of a regulatory enforcement gap: a well-functioning regime in which entitlements were easy to realise would leave little room for intermediaries to profit from realising them. Corrective platforms are, in this sense, a market-based symptom of incomplete public enforcement. Policy responses divide accordingly. Regulators who wish to suppress the intermediary market should attack Layer 3 directly, mandating automatic, airline-initiated compensation so that passengers need not claim at all, an option already foreshadowed by rulings permitting airlines to compensate passengers directly and by debates over curbing claims-management intermediation (Thijssen & Williams, 2019). Regulators who instead treat corrective platforms as useful private enforcers should focus on protecting consumers within that market by capping fees, ensuring transparency and policing aggressive practices, while the parallel expansion of alternative and online dispute resolution offers a complementary, lower-cost channel for redress (Hipp, 2019). Either way, the framework makes explicit that the size of the corrective market is a policy choice expressed through the width of the enforcement gap.

7. Limitations and Research Agenda

As a conceptual contribution, the paper has the limitations characteristic of theory-building work. Its constructs and relationships are argued rather than measured, and the multiplicative functional form, though theoretically motivated, awaits empirical adjudication against additive alternatives. The framework is calibrated to the European air-transport context, where Regulation 261/2004 provides an unusually strong and well-defined entitlement; its transferability to weaker regulatory regimes, to other transport modes or to non-transport service failures is a matter for investigation rather than assumption.

tion. The taxonomy, likewise, is an analytical scheme whose cells and boundaries should be tested against the messy reality of hybrid firms.

These limitations define a research agenda. First, the hypotheses in Section 4 invite empirical testing with cross-jurisdictional, route-level and carrier-level data, particularly H4 and H5, which respectively probe the independence of corrective and distribution growth and the multiplicative form of the mechanism. Second, comparative work across regulatory regimes would illuminate the enforcement-gap mechanism by exploiting variation in entitlement strength. Third, the reflexive dynamic of Proposition 6, the tension between regulatory success and platform viability, could be examined through natural experiments around the introduction of automatic-compensation rules. Fourth, the construct of corrective intermediation should be tested for portability beyond air transport, to domains such as parcel logistics, telecommunications and energy, where structural volatility, regulatory entitlement and enforcement gaps may coexist. Finally, qualitative study of hybrid firms would refine the boundary conditions of the taxono.

A further limitation, and perhaps the most consequential for the framework's global reach, concerns the behaviour of the conceptual product $M_k \approx V \times R \times G \times S$ in geographies with substantially weaker or more fragmented legal regimes than the European one. The framework is calibrated to EU Regulation 261/2004, which supplies an unusually high value of R : the entitlement is clearly defined, the compensation amounts are fixed, and the judicial infrastructure for enforcement is mature. In contexts where R is low — for instance, in jurisdictions with nascent passenger-rights legislation, ambiguous compensation thresholds, or poor judicial access — the multiplicative logic predicts that even high values of V , G and S will fail to produce a commercially viable corrective market. This is not because disruption is less frequent or consumers less aggrieved, but because the entitlement layer is too thin to generate a tradable asset of sufficient value to sustain a platform's contingent-fee economics. In the ASEAN air transport context, Satayanurug's (2025) analysis of the extraterritorial limits of EC261 illustrates precisely how the absence of a comparable regional entitlement regime suppresses the corrective market despite high levels of structural volatility. In the United States, the patchwork character of federal consumer-protection rules and the dependence on Department of Transportation enforcement rather than individual private rights of action creates a configuration in which G is high but R is institutionally fragmented, generating a corrective market that is active but structurally constrained relative to the European case. These observations suggest that the portability of the CDI framework is better understood as a function of regulatory infrastructure strength rather than aviation market size or disruption frequency alone: CDIs scale where R provides a robust, monetisable floor. Future work should therefore test

whether the multiplicative form degenerates predictably as R approaches zero and whether hybrid institutional arrangements — such as private ombudsman schemes or contractual guarantee products — can partially compensate for a thin entitlement layer, effectively elevating R endogenously.

8. Conclusion

This paper began from a simple observation that the prevailing theory of tourism digitalisation cannot accommodate: that a class of fast-growing digital firms creates value only when the travel product fails. We have argued that these firms, air passenger rights platforms such as AirHelp, constitute a distinct organisational form, the corrective digital intermediary, whose growth is independent of, and explained by entirely different forces from, the dynamic packaging and distribution innovations with which they are routinely conflated.

The framework developed here locates the corrective intermediary outside the tourism value chain and accounts for its emergence through four interacting layers (structural volatility, regulatory entitlement, an enforcement gap and platform scalability) whose multiplicative interaction determines the latent magnitude of the corrective market. From this mechanism we derived a set of propositions and testable hypotheses and a two-dimensional taxonomy that reveals corrective intermediation as the previously empty cell of digital intermediation theory.

The broader contribution is a more differentiated understanding of platform diversity in tourism ecosystems. Distribution platforms and corrective platforms are not points on a single continuum of digitalisation but distinct species occupying different phases of the consumption cycle and obeying different logics. Recognising this distinction sharpens theory, redirects managerial attention and, perhaps most consequentially, reframes the existence of corrective platforms as a measurable signal of where public enforcement of consumer rights falls short. As nature-based and mass tourism alike continue to expand against a backdrop of increasingly volatile transport systems, the corrective intermediary is likely to become a more, not less, prominent feature of the tourism landscape, and a more important object of theory, strategy and policy.

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TERRITORIAL INNOVATION AND GOVERNANCE: AN INTEGRATED RIS4 MODEL FOR THE TRANSITION OF SMART SPECIALISATION STRATEGIES TOWARDS SUSTAINABILITY

Territorial innovation and governance: An integrated RIS4 model for the transition of smart specialisation strategies towards sustainability

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ABSTRACT

This article proposes an Integrated RIS4 Synthesis Model as a framework for the transition from Smart Specialisation Strategies (S3) to regional innovation and sustainability (RIS4). The model brings together three theoretical pillars, the classical S3, the Purpose-Driven Smart Specialisation and the Challenge-Oriented Regional Innovation Systems to address the systemic disconnect between formal governance and transformative action, conceptualised as the “institutional black hole”. Through a heuristic analysis of the Region of Murcia and the cross-cutting tourism sector, the study demonstrates how the “innovation-exovation” dynamic and collaborative leadership can reorient regional assets towards the European Green Deal. The article concludes that the successful implementation of RIS4 requires overcoming administrative formalism through rigorous asset audits and inclusive, resilient, place-based governance.

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1. Introduction

The evolution of territorial innovation and governance, through Smart Specialisation Strategies (S3), has become central to sustainable regional development, particularly within the European Union. Formalised in the European context from the late 2000s onwards, the concept encourages regions to invest in areas of specific advantages. It promotes a place-based approach that prioritises stakeholder collaboration as a driver of growth and competitiveness (Barca, 2009; Foray et al., 2009; McCann & Ortega-Argilés, 2015). (EC, 2014) However, over the last decade, the paradigm has shifted from purely sectoral innovation policies towards integrated frameworks that incorporate social and environmental objectives, aligning with the European Green Deal and the UN Sustainable Development Goals (EC, 2019; Schot & Steinmueller, 2018; United Nations, 2015). This transition to a new generation of smart specialisation strategies for sustainability (RIS4) requires innovation to cease being viewed as an end in itself and instead become a driver of systemic and resilient change (Schot & Steinmueller, 2018).

Despite the widespread adoption of these policies, their practical implementation has revealed complex challenges. Firstly, studies on the implementation of RIS3 (Research and Innovation Strategies for Smart Specialisation) show that formal coordination structures do not, in themselves, guarantee effective processes of entrepreneurial discovery, which are often limited by formalism and low operational capacity (Capello & Kroll, 2016; Kroll, 2015). Secondly, the literature warns of the risks of strategic mimicry and weak territorial differentiation when regions copy others' priorities rather than basing their choices on local assets and technological proximity (Boschma, 2015; McCann & Ortega-Argilés, 2015). Furthermore, difficulties persist in effectively engaging civil society, despite the quadruple helix framework, which proposes the integration of academia, industry, government and the public in the production of innovation (Carayannis & Campbell, 2009, 2010). The integration of social and ecological dimensions also remains uneven in relation to economic objectives, reinforcing the need for a more adaptive and resilience-oriented approach to governance (Folke et al., 2005; Martin & Sunley, 2015). We propose the analytical category of the "institutional black hole", building on and extending Nieth's (2019) work, to characterise the systemic disconnect between formal governance architectures and the transformative administrative capacity required to translate priorities into action.

Given this transition scenario and the institutional obstacles identified, the guiding research question is how can S3 be reconfigured into sustainability agendas to promote territorial resilience and climate neutrality through adaptive governance models? This study seeks to demonstrate that the success of RIS4 depends on the ability of territories to overcome administrative rigidity and formalism by adopting collaborative lead-

ership that aligns local competencies with global sustainability goals (Folke et al., 2005; Sotarauta & Beer, 2017).

To address this challenge, the primary contribution of this article is the proposal of the Integrated RIS4 Synthesis Model. As the central theoretical output of this research, the model articulates the normative direction of Purpose-Driven Smart Specialisation (S3+P) with the systemic response of Challenge-oriented Regional Innovation Systems (CoRIS). By integrating the "innovation-exovation" dynamic, the model provides a robust framework for asset auditing and ensuring that territorial agendas are inclusive and resilient.

To ground the conceptual argument, the article draws illustratively on the Region of Murcia and the cross-cutting domain of tourism. Murcia is used throughout as a heuristic mirror that helps visualise the tensions between formal governance ambition and implementation capacity that the paper theorises. Furthermore, tourism is presented as a paradigmatic laboratory for observing the quadruple helix in action and the transition to sustainability in sectors traditionally sidelined in innovation policy debates (Romão & Nijkamp, 2018; Weidenfeld, 2018).

2. Methodology

This article adopts a conceptual approach (Jaakkola, 2020), grounded in a narrative review of the literature on territorial innovation, regional governance, and S3 (Baumeister & Leary, 1997; Paul & Criado, 2020; Snyder, 2019). It constitutes an analytical synthesis that seeks to identify patterns, tensions and gaps in the existing theoretical framework, contributing to the debate on the transition towards regional sustainability agendas. The choice of a narrative review, rather than a systematic or integrative one, is consistent with the article's purpose of constructing a critical conceptual synthesis that articulates distinct theoretical traditions and supports the proposition of an integrated framework.

The selection of the literature was guided by the authors' familiarity with the fields of regional studies and innovation policy, prioritising: seminal works underpinning the conceptual development of S3, the EDP, and multi-level governance; more recent theoretical extensions, particularly S3+P and CoRIS; contributions addressing the integration of sustainability into regional innovation strategies; and works problematising institutional capacities and gaps in regional innovation systems, with particular attention to Nieth's (2019) formulation of the institutional black hole.

The analysis was interpretative and iterative, organised around four recurring thematic axes: EDP; multi-level governance and institutional capacities; sustainability and territorial transitions; and institutional tensions and gaps. The cross-reading of these axes across the S3, S3+P and CoRIS frameworks enabled the identification of convergences, tensions and omissions that underpin the proposal of the inte-

grated RIS4 model. The aim was to understand how the S3 paradigm has evolved, where the main implementation difficulties persist, and how the new conceptual frameworks address these limitations.

This approach is appropriate to the article's objective, which is not to test hypotheses but to construct a well-founded argument regarding the necessary reconfiguration of regional innovation strategies in the face of contemporary sustainability challenges. The Region of Murcia is mobilised throughout the article with an illustrative and heuristic function (Siggelkow, 2007) rather than as a strict empirical case study. Its selection was based on its representativeness as a Mediterranean, middle-income region embedded in the European S3 framework; the presence of institutional tensions consistent with the notion of institutional black hole; and the centrality of tourism and agri-food as strategic sectors, allowing the applicability of the RIS4 model to key sustainability domains to be illustrated.

3. Theoretical Framework

3.1. Origins and Principles of Smart Specialisation Strategy

S3 has emerged as the central pillar of regional development policy in the European Union and in various global contexts, reshaping the way in which regions approach growth based on innovation and competitiveness. Initially developed in 2008 by the "Knowledge for Growth" expert group and formalised in the publications by Foray et al. (2009, 2011, 2012). S3 encourages regions to identify and invest in areas where they possess unique strengths, promoting competitiveness through localisation, strategic prioritisation and the active involvement of local stakeholders. This strategy is grounded in a place-based approach, which utilises territorial assets and resources to define a limited set of investment priorities, representing a paradigm shift from generic, centralised (top-down) innovation policies (Barca, 2009; McCann & Ortega-Argilés, 2015).

The conceptual evolution of S3 reflects shifts in thinking about regional development. Unlike traditional policies, which treated innovation as an end in itself, smart specialisation positions it as a means of achieving sustainable and inclusive territorial development (Foray, 2014). It is recognised that knowledge and research are the pillars of smart growth, which requires each region to identify its distinctive characteristics and competitive advantages in order to achieve excellence. The designation of S3 as an 'ex-ante conditionality' for access to the Structural and Investment Funds has compelled regional governments to develop robust strategies (McCann & Ortega-Argilés, 2016), which has generated extensive academic attention on how to operationalise these policies to support regional transformation (Foray et al., 2012).

3.2. The Entrepreneurial Discovery Process: from the Triple Helix to the Quadruple Helix

The methodological core of S3 implementation is the Entrepreneurial Discovery Process (EDP), which puts into practice the principle that effective territorial development stems from systematic collaboration among strategically positioned actors (Foray et al., 2009). The EDP represents a break with purely technocratic policy-making; rather than central authorities determining priorities, the process emphasises bottom-up learning and the generation of collective intelligence, with a view to identifying latent comparative advantages and defining technological trajectories with growth potential.

In its original formulation, the EDP was based on Etzkowitz and Leydesdorff (2000) triple helix model, linking academia, industry and government as the central pillars of regional innovation. This tripartite architecture formed the conceptual basis of the RIS3 Guide (Foray et al., 2012), which provided the framework for the first generation of strategies during the 2014-2020 programming period. However, the guide itself acknowledged that this framework was insufficient in the face of the growing complexity of regional innovation systems and the need to capture perspectives from the demand side, users and civil society.

The conceptual evolution of the EDP has thus led to the gradual incorporation of the quadruple helix model (Carayannis & Campbell, 2009; Carayannis & Grigoroudis, 2016), which adds civil society as the fourth constituent vertex of the innovation system. This extension reflects the recognition that innovation is not limited to the dynamics between knowledge, the market and regulation, but also depends on social legitimacy and the democratic ownership of technological trajectories. In the 2021-2027 programming period, civil society participation has moved from being merely recommended to becoming one of the enabling conditions for access to structural funds. Carayannis and Campbell (2010) also proposed the quintuple helix, integrating the natural environment as the fifth vertex, an extension particularly consistent with the transition to RIS4 (Research and Innovation Smart Sustainable Specialisation Strategies) and with the centrality of ecological sustainability in contemporary regional agendas.

Despite this regulatory reinforcement, the literature shows that the implementation of the quadruple helix remains uneven. Civil society participation has remained low in many contexts, despite the strong rhetorical emphasis on this pillar (Valdmaa et al., 2021). Comparative studies in regions with high institutional capacity suggest that the success of the EDP depends on specific mechanisms that foster inclusion and translate engagement into effective policy outcomes, avoiding the risk of merely formal participation (Aranguren & Wilson, 2013). The EDP should therefore be understood as a continuous learning process, capable of reorienting strategies in response to contextual changes, rather than as a linear or exclu-

sively consultative procedure.

The tourism sector embodies this collaborative dynamic, as the provision of products in a destination requires the involvement of a diverse range of economic activities, institutional actors and local communities. This decentralised value chain enables the creation of deep links within local economic structures, making tourism a driver of social innovation and territorial networking that is particularly well-suited to the logic of the quadruple helix.

3.3. Multilevel Governance and Coordination

The successful implementation of RIS3 depends on a governance model capable of coordinating actions across multiple institutional levels and policy domains. The multi-level governance framework is fundamental to understanding how these policies are designed in contexts where responsibilities are distributed amongst national, regional and local governments, as well as amongst non-state actors (Barca et al., 2012). Strong, harmonious and balanced synergies between stakeholders and across levels of government are necessary conditions for the success of S3 (Wibisono, 2022).

The literature reveals that governance challenges often manifest themselves in institutional readiness, vertical and horizontal coordination, and the alignment of policy objectives (Capello & Kroll, 2016). In contexts of institutional fragility, these challenges are exacerbated by barriers such as the fragmentation of legal regulation and the purely formal nature of EDP. The impact of these policies depends on the quality of public administration and the ability to integrate S3 into unified strategic planning systems, thereby overcoming the conceptual ambiguity surrounding priorities such as competitiveness and sustainability (Di Cataldo et al., 2022).

3.4. Theoretical Extensions: S3+P and the CoRIS Framework

To address the complex problems of sustainability, the academic literature has expanded the conceptual boundaries of S3 through two main models:

Purpose-Oriented Smart Specialisation (S3+P): this framework, developed by Silva et al. (2026), incorporates “shared purpose” as an organising principle to strengthen the direction and legitimacy of regional strategy. S3+P operates through five catalytic mechanisms (plasticity, temporality, identity, memory and relational networks) that link individual and territorial dimensions to macro-policy objectives, preserving the logic of discovery whilst imbuing it with greater social intent. The framework also proposes a six-stage policy cycle and a set of indicators that extends evaluation beyond conventional innovation metrics.

Challenge-oriented Regional Innovation Systems (CoRIS): this approach, introduced by Tödtling et al. (2022) and de-

veloped by Trippel et al. (2024), reorients innovation systems towards addressing territorial sustainability challenges. The model emphasises the need to pursue economic competitiveness, environmental sustainability and social equity simultaneously. A central concept in CoRIS is the innovation-exnovation dynamic, which focuses both on the development of innovative solutions and on the deliberate phasing out of unsustainable practices and technologies, requiring a reconfiguration of existing innovation systems.

3.5. The Transition to Sustainability and the RIS4 Paradigm

The integration of sustainability into regional innovation strategies represents the current frontier of territorial policy. This development, referred to as the path to RIS4 (Meyer, 2022) aligns regional strategies with global frameworks such as the European Green Deal and the 2030 Agenda (Lankauskiene et al., 2022). This transition is particularly relevant for the recovery of sectors severely affected by the pandemic crisis, such as tourism. Integrating the sustainability dimension enables destinations to reduce their economic volatility by promoting diversification into non-tourism sectors and increasing the territory’s overall resilience. This transition means that S3 ceases to be a strictly sectoral policy and instead becomes an integrated framework that addresses competitiveness alongside social inclusion and climate neutrality.

The literature emphasises that regional innovation and the green transition can mutually benefit from the transformative and collaborative nature of S3. The integration of these goals is uneven. The discourse on economic and environmental sustainability is there but the social dimension and social innovation are integrated less consistently (Meyer, 2022). Moreover, the application of sustainability-oriented frameworks faces problems of justice (distributive, procedural and recognition-based), requiring place-sensitive approaches that recognise communities’ non-monetary connections to their territories. The success of this transition depends on overcoming deep mimicry, whereby regions copy their neighbours’ priorities (Deegan et al., 2021; Di Cataldo et al., 2022), in favour of rigorous capacity audits that confirm the actual potential of regional assets for sustainability whilst also overcoming the difficulties in implementing complex diversification strategies (Balland et al., 2019).

4. Discussion

The reconfiguration of S3 into sustainability-oriented agendas (RIS4) does not constitute a simple incremental adjustment to the previous paradigm, but a change in the logic behind territorial innovation policies. This section articulates this transformation around six analytical axes that address the research question set out in the introduction, drawing on the

theoretical framework presented earlier and using the case of Murcia merely as an illustrative example, in keeping with the conceptual nature of the article.

4.1. From Innovation as an End to Innovation as a Means

The first analytical shift concerns the epistemological status attributed to innovation. In its original formulation, S3 treated innovation as the central objective of regional policies, based on the assumption that the identification of latent comparative advantages and their mobilisation through the EDP would be sufficient to generate growth and competitiveness (Foray, 2014; Foray et al., 2009). Transitioning to RIS4 means that innovation plays an instrumental role, no longer being an end in itself, but a vehicle for systemic transformations towards climate neutrality, social inclusion and territorial resilience (Meyer, 2022).

This reorientation corresponds to what Schot and Steinmueller (2018) refer to as the transition from the second to the third framework of innovation policy, in which the focus shifts from national innovation systems to transformative change. Meyer (2022) emphasises precisely that the integration of social innovation governance into S3 constitutes the decisive step towards the emergence of a RIS4, in which the social dimension takes on a central role equivalent to that of the economic and environmental dimensions. This reinterpretation is in line with the CoRIS framework (Tödtling et al., 2022; Trippel et al., 2024) that realigns regional innovation systems towards addressing societal challenges and introduces the innovation-exnovation dynamic as a structuring element: innovating at the same time means phasing out unsustainable practices and technologies in a deliberate manner.

The transition to RIS4 is therefore not merely additive. It requires a reconceptualisation of the EDP itself, which must incorporate criteria guiding where innovation takes place and for what purpose, rather than merely criteria of allocative efficiency.

4.2. The Asymmetry Between Governance and Implementation and the Institutional Black Hole

The second analytical axis concerns one of the most persistent tensions in the literature, the asymmetry between formally sophisticated governance models and effective implementation capacities. Capello and Kroll (2016) and Kroll (2015) demonstrate that the existence of formal coordination structures does not, in itself, guarantee substantive processes of entrepreneurial discovery. In many contexts, the EDP was institutionalised as an exercise to comply with the ex-ante conditionality imposed by the European Commission (2014) without having effectively induced collective learning or strategic reorientation.

Di Cataldo et al. (2022) This phenomenon can be inter-

preted through the lens of what Nieth (2019) termed the “strategic black hole” in regional innovation coalitions, originally identified in her study of the Twente region as a gap between coalition rhetoric and actual strategic agency. We extend this notion into the concept of an institutional black hole, broadening its scope beyond coalition dynamics to encompass the wider administrative, coordination and monitoring architecture of RIS3/RIS4. In our reformulation, the institutional black hole designates a systemic space where strategies are formally produced, but where administrative capacities, vertical and horizontal coordination mechanisms, and monitoring arrangements are insufficient to translate priorities into transformative action. This extension connects Nieth’s coalition-level insight with the governance-implementation asymmetries documented by Capello and Kroll (2016) Aranguren et al. (2019) and Di Cataldo et al. (2022).

Aranguren et al. (2019), in their analysis of the EDP, note that actual governance practices rarely align with the participatory model envisaged in the founding literature. This asymmetry is exacerbated by difficulties in coordinating the multiple levels of governance (Barca et al., 2012; Wibisono, 2022; Wibisono et al., 2025). In practice, however, multilevel governance often faces overlapping competences, time lags between political cycles and deficits in technical capacity within the regional administrations, in particular in less developed regions.

4.3. Strategic Mimicry

The third strand addresses a recurring phenomenon in S3 evaluations, namely strategic mimicry. Boschma (2015) and McCann and Ortega-Argilés (2015) were among the first to warn of the risk that regions copy the priorities of neighbouring territories or of models considered successful, without conducting a rigorous analysis of their technological proximity, relationality, and asset density. Deegan et al. (2021) and Balland et al. (2019) demonstrate empirically that successful regional diversification depends on the relationship with pre-existing capabilities, rather than on adherence to fashionable technological agendas.

A prime example of this dynamic is the proliferation of regional priorities linked to green hydrogen in the post-2020 European context. Following the launch of the European Union’s Hydrogen Strategy (EC, 2020), numerous regions incorporated hydrogen into their specialisation strategies without possessing the industrial assets, research capacity or energy infrastructure that would credibly underpin such a commitment. The result tends to be a dispersal of resources, the overlapping of competing initiatives and a loss of territorial coherence, exactly the opposite of what S3 sought to avoid.

Mimicry is particularly problematic in the context of the transition from RIS3 to RIS4, because sustainability priorities carry high political visibility and symbolic appeal but require very specific material and cognitive assets. Without rigorous

capacity audits (Balland et al., 2019), the transplantation of priorities turns RIS4 into a rhetorical exercise, exacerbating the institutional black hole described in the previous section.

4.4. Purpose and Challenge-Driven Frameworks as Responses to Wicked Problems

The fourth analytical axis examines the two most relevant theoretical extensions for addressing complex sustainability problems: S3+P and CoRIS.

Both frameworks share a common diagnosis: S3, even when well implemented, is insufficient to tackle problems that are, by their very nature, cross-cutting, contested and long-standing. The wicked problems of sustainability (climate change, biodiversity loss, territorial inequality) do not respect sectoral boundaries or political cycles, requiring explicit direction and greater social legitimacy. S3+P introduces shared purpose as an organising principle, operationalised through the five catalytic mechanisms that link the individual, territorial and macro-political scales (Silva et al., 2026). CoRIS, for its part, reconfigures regional innovation systems to simultaneously pursue competitiveness, sustainability and equity, recognising that this involves not only creating the new but also dismantling the unsustainable, as well as the innovation-exovation dynamic (Tödtling et al., 2022; Trippel et al., 2024).

The complementarity between the two frameworks is striking: while S3+P provides the normative framework (why and for what purpose), CoRIS offers the systemic framework (how to reorganise existing systems). Figure 1 synthesises this complementarity in an Integrated RIS4 Model, illustrating the transition from traditional sectoral innovation to purpose-driven, sustainable territorial governance. Together, they address the criticism raised by Schot and Steinmueller (2018) regarding the need for transformative innovation policies and engage directly with Meyer's (2022) proposal on the path towards RIS4.

The model articulates three components namely a foundation in the S3 paradigm; a theoretical integration engine in which S3+P provides normative direction (shared purpose, social legitimacy, identity and memory) and CoRIS provides the systemic response (challenge-driven governance, innovation-exovation dynamic); and a resulting RIS4 paradigm grounded in the quintuple helix and oriented towards climate neutrality, territorial resilience and social equity. The entire framework is based on a key governance principle: the transition from administrative formalism to territory-centred leadership, supported by collaborative leadership, asset audits and multilevel coordination at various levels.

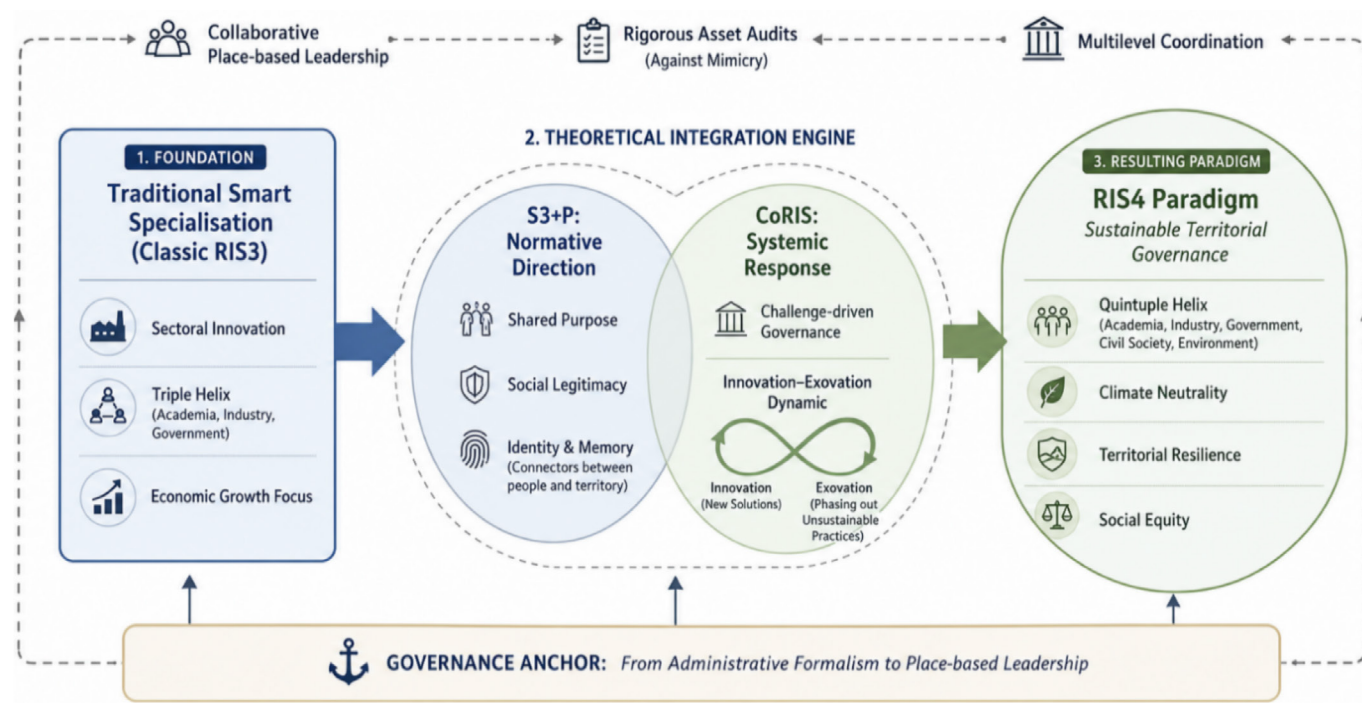


Figure 1: The Integrated RIS4 Synthesis Model.

Source: Developed by the author.

4.5. The Case of Murcia as an Illustration of the RIS4 Paradigm in Practice

By way of illustration, the case of the Region of Murcia provides a useful example for visualising the tensions discussed. Murcia developed one of the first regional strategies to explicitly integrate sustainability objectives¹, linking its traditional agri-food specialisation to priorities relating to water resources, the environment and maritime energy (Región de Murcia, 2022). The strategy sought to align itself with the European Green Deal, attempting a transition from the RIS3 approach to one closer to RIS4.

The Murcian case study illustrates three dimensions discussed in the previous sections. Firstly, it highlights how pre-existing specialisation (in the agri-food sector) can be reoriented towards sustainability objectives without abrupt disruptions, in line with the logic of technological proximity advocated by Balland et al. (2019). Secondly, reading the case through the lens of Silva et al.'s (2026) S3+P framework, the integration of the water dimension (critical in a region historically affected by water stress) can be understood as serving a mobilising, purpose-driven function within the strategy. Thirdly, although the RIS4 documentation presents its governance model as highly participatory, the broader literature on institutional “black holes” (Nieth, 2019) and on uneven civil society engagement (Valdmaa et al., 2021) suggests that such coordination challenges are likely to persist in practice, even where they are not explicitly acknowledged in official strategy documents.

Murcia thus functions as a mirror of the possibilities and limitations of the RIS4 paradigm, not as proof of its effectiveness but as a heuristic case study that brings to life the analytical categories employed.

4.6. Cross-Cutting Domains for RIS4: The case of Tourism

The sixth strand illustrates how the RIS4 paradigm operates in cross-cutting sectoral domains, taking tourism as one representative example. Despite being one of the most frequently cited areas of specialisation in European regional strategies, tourism has been treated as a marginal issue in the theoretical debate on S3 (Biagi et al., 2021; Weidenfeld, 2018). This marginalisation reflects a narrow conception of innovation, still rooted in technological and industrial models, and offers a useful lens through which to observe the categories developed above.

The decentralised nature of the tourism value chain gives the sector a cross-cutting character, making it particularly well-suited to the sustainability paradigm. Tourism naturally links the four helices (Carayannis & Grigoroudis, 2016), mo-

bilises local economic sectors and generates territorial externalities that extend beyond its sectoral boundaries.

Within the transition to sustainability, tourism presents itself as both a problem and a solution. It is a source of significant environmental and social pressures, but it is also a potential lever for diversifying dependent economies, enhancing heritage, and fostering social innovation. The COVID-19 pandemic has highlighted its volatility and reinforced the need to reorient it towards resilience and diversification, as proposed by Martin and Sunley (2015). Integrating tourism into strategies, through criteria of exovation (phasing out unsustainable mass tourism models) and targeted innovation (regenerative, decarbonised, community-based tourism), represents one of the most promising avenues for implementing the RIS4 paradigm (Meyer, 2022).

5. Conclusion

This article proposed an Integrated RIS4 Synthesis Model as its central theoretical contribution, articulating the normative direction of S3+P with the systemic response of CoRIS under a governance anchor of place-based collaborative leadership. The analysis organised around six key areas, the reconfiguration of the status of innovation, the governance-implementation asymmetry, strategic mimicry, purpose and challenge-oriented frameworks, the Murcian case study, and cross-cutting domain, such as tourism, supports the argument that the transition from S3 to RIS4 constitutes a paradigm shift rather than an incremental adjustment.

The reconfiguration to RIS4 is only viable if three conditions are met. Firstly, innovation must be explicitly repositioned as a means to serve societal ends, drawing on the S3+P and CoRIS frameworks to provide direction for policies. Secondly, multilevel governance must overcome formalism and the institutional black hole by investing in administrative capacity, substantive public-private engagement mechanisms, and collaborative local leadership (Sotarauta & Beer, 2017). Thirdly, regions must resist the temptation to follow others blindly, basing their priorities on rigorous asset audits and realistic technological development pathways.

The transition to sustainability, far from being a cosmetic overlay on existing policies, requires the effective integration of economic, social and environmental dimensions as a prerequisite for any robust, inclusive and resilient territorial agenda.

5.1. Theoretical and Policy Contributions

From a theoretical perspective, the article makes three contributions. Firstly, it develops the Integrated RIS4 Synthesis Model which offers a coherent architecture for understanding,

¹ <https://www.ris4regiondemurcia.es/en/>

designing and evaluating the RIS3 - RIS4 transition. Second, it brings together three bodies of literature that are usually treated in isolation: the founding literature on S3, S3+P, and CoRIS. Thirdly, it recovers and extends the concept of the “institutional black hole” from Nieth (2019), integrating it with the governance-implementation asymmetry mechanisms identified by Capello and Kroll (2016), Aranguren et al. (2019), and Di Cataldo et al. (2022) to propose a broader analytical framework for multilevel coordination failures in S3.

From a policy perspective, three main implications arise. Firstly, regional authorities should subject sustainability priorities to rigorous capacity audits before incorporating them into strategies, thereby avoiding the mimetic transplantation of agendas. Secondly, the EC and national authorities should strengthen administrative capacity-building mechanisms, particularly in less developed regions, where the risk of an institutional black hole is higher. Thirdly, the evaluation frameworks for regional strategies should be broadened to include indicators of exnovation, rather than merely indicators of the addition of new innovative activities.

5.2. Suggestions for Future Research

The conceptual nature of this article opens up several avenues for empirical and theoretical research. Firstly, comparative studies should be conducted across regions that have adopted similar priorities (e.g., hydrogen) to empirically test the hypothesis of mimicry and identify the mechanisms that distinguish substantive commitments from rhetorical exercises. Secondly, empirical research is needed to examine the concrete operationalisation of S3+P's catalytic mechanisms across different regional contexts. Thirdly, it is recommended that evaluation methodologies be developed to capture the innovation-exnovation dynamics proposed by the CoRIS framework, which has so far been scarcely operationalised. Fourthly, tourism merits an in-depth study as a laboratory for RIS4 transition, particularly in regions with strong sectoral dependence and high climate vulnerability. Finally, it would be valuable to investigate the relationship between collaborative place-based leadership and overcoming the institutional black hole, linking the framework of Sotarauta and Beer (2017) with recent assessments of administrative capacity in a European context.

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SHIPWRECK-BASED BLUE ENTREPRENEURSHIP IN

ISLAND TERRITORIES: A

Shipwreck-based blue entrepreneurship in island territories: a case study of *El Peñón* wreck in Tabaiba, Tenerife. A conceptual and practice-based case study of shipwreck-based blue entrepreneurship in an island tourist coastal territory

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ABSTRACT

This article examines the role of artificial wrecks as catalysts for blue entrepreneurship in island territories. The study is grounded in the proposition that deliberately scuttled vessels may generate tourism, training, business and territorial value when they are articulated with appropriate conditions of underwater singularity, accessibility, specialised training provision, entrepreneurial ecosystem development and coastal infrastructure. In contrast to approaches that interpret artificial wrecks solely as reefs, diving attractions or environmentally contested interventions, this paper proposes analysing them as small-scale blue infrastructures capable of activating value chains linked to recreational diving, specialised training, marine conservation, local identity and tourism services. The methodology adopts an explanatory case-study design, supported by light empirical validation based on simple indicators related to market structure, accessibility and territorial infrastructure. The case of El Peñón wreck in Tenerife, Spain, makes it possible to test five propositions: the experiential singularity of the wreck; its shore-based accessibility; its capacity to generate specialised training; the existence of an entrepreneurial ecosystem along the Tabaiba–Radazul axis; and the need for governance mechanisms to ensure its long-term sustainability. The results show that El Peñón operates as a structuring asset within the underwater ecosystem of Tabaiba–Radazul. Its value does not lie solely in the physical presence of the wreck, but rather in the network of products, services, courses, operators, infrastructures and narratives that have been organised around it. The article concludes that artificial wrecks may foster blue entrepreneurship in island and coastal destinations, but only when their recreational use is embedded within a governance model that combines safety, spatial regulation of uses, environmental monitoring, local participation and territorial return.

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1. Introduction

Island territories are defined by a permanent negotiation between land and sea. Their coastline is not merely a line of physical contact, but a productive, cultural, ecological and symbolic interface. On an island, the coastal strip operates simultaneously as an urban frontage, a mobility corridor, a recreational platform, an ecological edge, a tourism resource, a nautical infrastructure and an identity-forming landscape. For this reason, the blue economy in island contexts cannot be reduced to large-scale offshore sectors such as industrial fishing, aquaculture, commercial ports or marine energy. It also

includes situated, small- and medium-scale economies that emerge from the everyday interaction between coastal settlements, marine ecosystems, recreational practices and local entrepreneurship. Scuba diving should therefore be understood as a tourism system composed of interdependent actors, including divers, marine environments, host communities and the diving industry itself (Dimmock & Musa, 2015). This systemic interpretation is particularly relevant in island territories, where diving activity depends on the spatial articulation between coastal access, marine resources, local services, training providers and environmental governance.

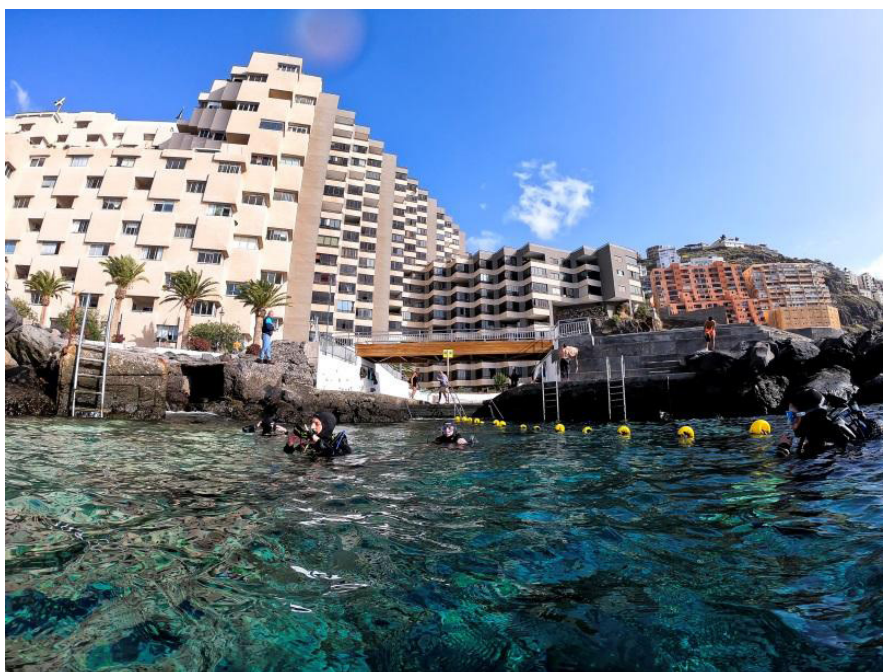


Figure 1: Urban pressure on the infralittoral zone in coastal tourism territories, defined according to the proximity between built development and the sea surface, recreational uses of the infralittoral area, and potential discharges and pollution. Tabaiba urban development, Tenerife.

Source: Juan D. López-Arquillo.

Recreational scuba diving occupies a particularly relevant position within this intermediate blue economy. Although it is not a mass activity in the same sense as conventional beach tourism, it generates a highly specialised service economy based on certification, safety protocols, equipment provision, local ecological knowledge, environmental interpretation, underwater guiding, shore- or boat-based logistics and repeat visitation. Although global estimates vary depending on whether only direct diving expenditure or broader tourism expenditure is considered, recreational scuba diving is consistently described as a significant marine tourism activity with relevant direct and indirect effects on local coastal economies (Dimmock & Musa, 2015; Genç, 2022; Morgan et al., 2009) with worldwide revenues estimated at approximately USD 4.55 billion in 2023 and projected to reach USD 8.83 billion

by 2030. Within this market, scuba diving constitutes the main segment, while broader assessments of recreational scuba diving suggest that its direct and indirect economic effects may reach several billions of dollars annually. These figures are especially relevant for island territories, where diving expenditure is not captured only by the price of an individual dive, but also by associated services such as training, equipment rental, accommodation, food and beverage, local mobility, boat operations, digital booking platforms and specialised retail. Within this system, dive centres operate as the primary engines of the local diving industry. They are not merely intermediaries between tourists and the sea, but technical, educational and entrepreneurial nodes that translate underwater resources into structured economic activity. This role is consistent with the scuba-diving tourism system framework, in which the diving

industry is understood as an intermediary between marine environments, tourists and host communities (Dimmock & Musa, 2015).

Recent official tourism data allow the relevance of scuba diving in Tenerife to be framed more precisely. According to the 2025 tourist profile by activities undertaken at destination published by the Canary Islands Tourism Observatory / Promotur, 168,933 tourists aged 16 or over reported scuba diving as an activity undertaken during their stay in Tenerife. This represents 2.6% of tourists in the island. Although scuba diving is therefore a specialised niche rather than a mass activity, it is a measurable segment within the island's tourism system. Tourists undertaking scuba diving showed an average expenditure per trip of €1,367, an average stay of 8.8 days and an average daily expenditure of €170.59. The same source estimates the total turnover associated with tourists undertaking scuba diving in Tenerife at €231 million, or €174 million when excluding flights (Observatorio Turístico de Canarias, 2026b). These figures do not establish a causal relationship between a specific dive site and tourism demand, but they confirm that scuba diving constitutes a statistically visible and economically relevant segment of Tenerife's tourism economy.

In the case of artificial wrecks, this intermediary role becomes even more important because operators translate a submerged structure into guided routes, safety protocols, certification pathways and marketable experiences (Seaman & Depper, 2019; Stolk et al., 2005). Dive centres organise access, certify skills, manage risk, interpret underwater environments, maintain equipment, create itineraries, produce local knowledge and connect visitors with wider coastal service networks. In territorial terms, they function as small-scale blue enterprises whose viability depends on the presence of attractive, recognisable and operationally reliable dive sites. Without stable

nodes of underwater interest, the local diving economy tends to remain fragmented, generic and weakly differentiated. Conversely, when a destination contains distinctive underwater assets, dive centres can transform them into specialised products, training pathways, repeatable experiences and locally embedded value chains.

Among dive sites, wrecks possess a singular capacity for attraction. A wreck is not simply a sunken object. It is a three-dimensional structure, a navigable spatial sequence, a technical challenge, a visual landmark, a habitat, a device of memory and a tourism product. For divers, a wreck offers an experience that differs substantially from dives over rocky, volcanic or sandy seabeds. It allows descent towards a recognisable object, circumnavigation of a hull, interpretation of superstructures, identification of reference points, planning around a maximum depth, refinement of buoyancy control, underwater photography and, only with specific training, controlled penetration routes. However, not all wrecks have the same operational, educational or safety profile. Natural or accidental wrecks, resulting from shipwrecks, collisions, storms, navigational errors or wartime events, often retain a high degree of material and spatial uncertainty. Their structural stability may be compromised; access points may be irregular; sharp metal edges, fishing gear, cables, enclosed compartments, silt deposits, unstable decks and entanglement hazards may increase risk; and their position, orientation and exposure to currents may not correspond to recreational or training requirements. These wrecks may have exceptional heritage, ecological or narrative value, but they are not necessarily suitable for systematic recreational use, repeated training activities or controlled tourism development. (Alves et al., 2022; Blagojević et al., 2023; Brown & Henderson, 2025; Lousada et al., 2022; Lousada, Cabezas, & Castanho, 2022).

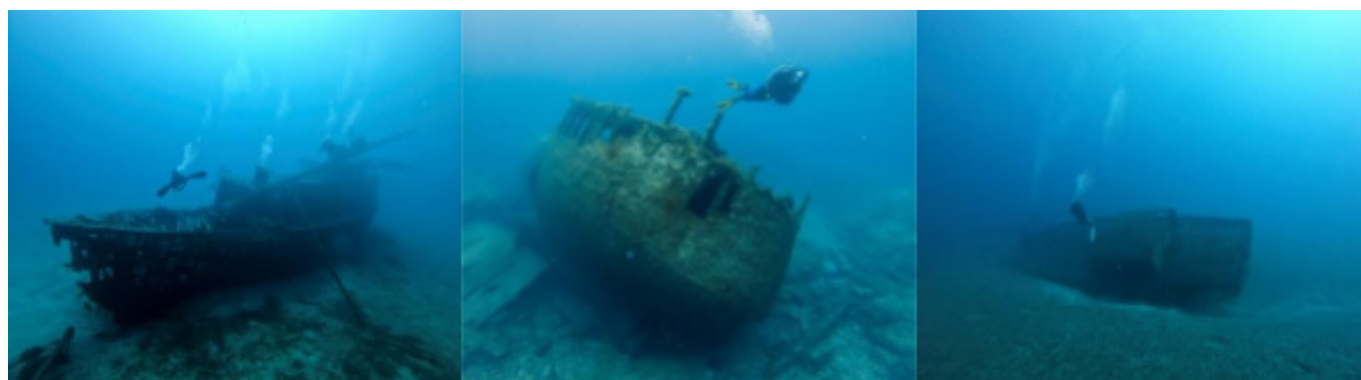


Figure 2: Wrecks in Tenerife. All the wrecks are located within the infralittoral zone and are accessible using recreational scuba-diving techniques. The examples shown include the *Meridian*, a former Second World War Kriegsmarine vessel that was used for whale-watching activities between 1971 and 2005; the *Condesito*, wrecked in 1973; and *El Gemelo*, deliberately sunk off Puerto Colón for the international diving market.

Source: Juan D. López-Arquillo.

By contrast, purpose-prepared or artificial wrecks may mitigate a significant part of these risk components when they are properly selected, cleaned, adapted, sunk and monitored. Vessels intentionally scuttled for diving can be stripped of hazardous materials, stabilised, opened through controlled access points, cleared of dangerous obstructions and positioned at depths and locations compatible with specific certification levels. Their value therefore lies not only in their capacity to function as artificial reefs, but also in their ability to provide a safer, more legible and more pedagogically useful underwater environment. Properly prepared wrecks can support progressive training, advanced buoyancy practice, orientation skills, supervised wreck-diving exercises and controlled forms of underwater interpretation, while simultaneously reducing pressure on more fragile natural habitats. From the perspective of coastal planning, an artificial wreck can therefore be understood as a small-scale blue infrastructure. This interpretation connects wreck-based entrepreneurship with marine spatial planning, understood as a process for organising human uses of marine space in order to reduce conflicts, improve ecosystem-based management and coordinate economic activities with environmental protection (Douvere, 2008; Ehler & Douvere, 2009). It is not a major harbour, an offshore platform or

a conventional tourism facility; rather, it is a submerged asset capable of organising economic relations, user flows, training practices, local services and governance requirements. Its value does not lie solely in its metallic mass, but in the network of access points, operators, services, regulations and narratives that it enables. In this sense, the wreck can operate as an underwater centrality within a broader coastal system.

The selected case is the wreck of *El Peñón*, located off Tabaiba, in Tenerife. This wreck is a former tugboat deliberately scuttled in 2006 to function as an artificial reef and dive site. Its location only a short distance from the coast, its approximate depth of 30 to 32 metres, its recognisable hull and its proximity to the Tabaiba–Radazul axis make it a particularly suitable case for analysing wreck-based blue entrepreneurship. The worldwide Professional Association of Diving Instructors – PADI– describes the site as one of the best-preserved wrecks in Tenerife, located only a few metres off the coast of Tabaiba and sunk at a depth of around 30 metres, with training relevance for Advanced Open Water Diver and Wreck Diver certification pathways. Tourism information from the Canary Islands also identifies the vessel as having been sunk in 2006 as an artificial reef intended to enrich marine life and promote scuba diving, with a maximum depth of approximately 32 metres.

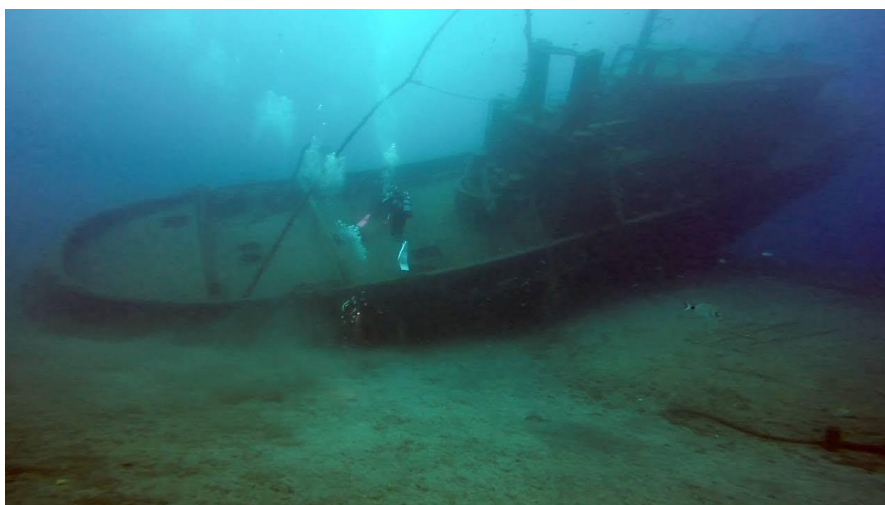


Figure 3: Current condition of the *El Peñón* wreck. Its upright position evidences the intentional nature of the scuttling—showing only a starboard list caused by the morphology of the seabed—as well as the absence of hazardous elements for divers, such as nets and cables, which are commonly associated with natural or accidental wrecks.

Source: José M. Peinado Martín.

This article addresses the following research question: how can an artificial wreck act as a catalyst for blue entrepreneurship in an island territory? This question is applied to the case of *El Peñón* through five explanatory propositions. The first argues that the wreck generates a differentiated and marketable underwater experience. The second proposes that its shore-based accessibility increases its operational and business value. The third considers that its depth and configuration

enable advanced training products. The fourth suggests that its effect is reinforced by the existence of a local diving ecosystem along the Tabaiba–Radazul axis. The fifth argues that its sustainability depends on governance, maritime safety, environmental monitoring and the spatial regulation of uses. The article does not claim that the sinking of *El Peñón* mechanically caused the creation of all nearby diving businesses. Such a claim would be methodologically weak. Rather, it proposes

interpreting the wreck as a structuring asset within a broader coastal system. *El Peñón* reinforces the identity of the area as a diving destination, adds a specialised product to the local and island-wide tourism offer, supports advanced training, attracts operators from other parts of Tenerife and intensifies the need for urban-maritime planning. The causal logic is therefore not linear, but infrastructural and relational: the wreck generates value when it is connected to accessibility, operators, training, services and governance.

2. Literature Review

2.1. Blue economy, Island Territories and the Coastal Interface

The blue economy has become a consolidated framework for analysing the sustainable use of marine and coastal resources, particularly in Europe's outermost regions. Although it is often associated with large-scale maritime sectors such as ports, fisheries, aquaculture or offshore energy production, it also encompasses small-scale activities linked to coastal communities, leisure, education, conservation and tourism. In island territories, this dimension is particularly relevant because the sea is not external to urban and territorial life. Rather, it forms part of the everyday geography of mobility, labour, identity, recreation and environmental responsibility, while also constituting the material basis of freight transport and supply-chain continuity. In the case of the Canary Islands, this interpretation is reinforced by regional blue economy strategies that explicitly link maritime identity, training, innovation, environmental protection, competitiveness and coastal development (Gobierno de Canarias, [2021](#); Fernández Fernández et al., [2022](#)). At the European level, the renewed strategy for outermost regions also frames the blue economy and biodiversity as strategic assets for sustainable development and opportunity creation (European Commission, [2022](#)).

From an urban-planning perspective, island coastlines should be interpreted as hybrid spaces. They are neither purely natural nor strictly urban. They include residential developments, tourism facilities, coastal roads, beaches, marinas, fishing infrastructures, promenades, stairways and ramps providing access to the sea, informal recreational spaces and underwater landscapes. The coast is therefore a socio-spatial interface. The value of a marine resource does not depend solely on its ecological or scenic qualities, but also on its accessibility, connectivity, edge services, regulatory framework and capacity to become integrated into the wider territorial system.

This interpretation is especially important for underwater tourism. Dive centres constitute the operational node that makes diving activity possible. This is because scuba diving depends on specialised equipment with a markedly technical and industrial character, particularly cylinder-filling systems, which involve compressed air at pressures exceeding 200 at-

mospheres and are therefore subject to specific inspection, authorisation and control by industrial-safety departments within local and national administrations. Dive centres enable the experience by organising access to dive sites either through dive boats or through shore-based entry points. A dive site becomes economically relevant when it can be connected to urban and logistical systems: road access, public transport, parking provision, safe entry and exit points, emergency-response capacity, equipment transport, proximity to compressors, classrooms, accommodation and food-and-beverage services.

Consequently, the entrepreneurial capacity of a dive site is inseparable from the spatial structure of the coastline. The underwater resource and the urban-coastal fabric operate as a combined system. In this sense, underwater tourism should not be understood merely as the consumption of a natural or scenic asset, but as the result of a territorial assemblage in which marine resources, coastal accessibility, technical infrastructure, business operators, safety regulations and local services jointly produce economic value.

2.2. Artificial Reefs and Deliberately Scuttled Vessels

Artificial reefs are human-made submerged structures that can modify substrate availability, increase spatial complexity, promote biological colonisation, protect resources, enhance fisheries productivity or create recreational opportunities. Deliberately scuttled vessels constitute a specific typology within this broader category: artificial wrecks. These are obsolete, seized, military, commercial or decommissioned vessels that have been previously prepared and sunk under controlled conditions in order to generate a submarine structure. The deliberate sinking of vessels is technically, legally and environmentally complex. It should not be understood as a simple waste-disposal operation. It requires vessel assessment, removal of contaminants, cleaning of fuels and oils, treatment of hazardous materials, analysis of structural stability, site selection, compatibility with navigation, evaluation of potential ecological effects, administrative authorisation and post-deployment monitoring. In the Spanish and international context, such operations are connected to regulations concerning dumping at sea, marine protection, coastal management, ship recycling, maritime safety and environmental assessment (Jaume Munar, [2020](#)). From the perspective of their intended purposes, artificial reefs may be linked to production, protection, restoration, research, education, tourism or recreation. The recreational objective becomes particularly relevant when the structure is a vessel. A sunken ship has immediate experiential value for divers because it offers recognisable geometry, vertical relief, orientation references and a sense of exploration. For this reason, a scuttled vessel can be understood as an underwater infrastructure intentionally arranged to produce specific forms of use.

International experience shows that deliberately scuttled

vessels are increasingly being used as instruments of underwater destination-making. Malta is one of the clearest European examples. Its diving offer is strongly associated with wrecks such as the *Um El Faroud*, *P29*, *Rozi*, *Imperial Eagle*, *Karwela* or *Cominoland*. Some of these vessels were deliberately sunk to create artificial reefs and diving attractions, while others have been incorporated into the recreational diving circuit as structured underwater assets. The *Um El Faroud*, for example, was scuttled off Wied iż-Żurriq in 1998 after a decontamination process and has become one of Malta's most emblematic recreational wreck dives. Malta provides a useful comparative reference because wreck diving forms part of its tourism positioning, with artificial and historical wrecks contributing to destination image, diver motivation and repeat visitation (Cardona, 2025).

Madeira provides a second relevant case. The deliberate sinking of the Portuguese Navy corvette *Afonso Cerqueira* off Cabo Girão in 2018 created one of the island's most recognisable wreck-diving attractions. The vessel, approximately 85 m long, was prepared and sunk to operate as an artificial reef and recreational dive site. Its position, depth range and structural legibility allow it to function simultaneously as an ecological substrate, an underwater photographic object, an advanced diving destination and a business resource for local operators. Madeira's experience is particularly relevant for island territories because the wreck does not operate in isolation: it is connected to boat logistics, coastal resorts, dive centres, underwater visibility, marine biodiversity and the broader tourism economy of the island.



Figure 4: Images of *Dori* wreck, in São Miguel, Azores (PT). Propeller, partially buried in the substrate; beams of the main deck; and remains of the keel.

Source: Juan D. López-Arquillo.

The Azores offer a complementary perspective. The archipelago contains well-known historic and accidental wrecks, such as the *Dori* off São Miguel, a Second World War Liberty ship that sank near Ponta Delgada in 1964 and has become one of the island's most iconic dive sites. Unlike deliberately scuttled artificial wrecks, the *Dori* was not designed as a recreational infrastructure. Nevertheless, its subsequent incorporation into the diving economy shows how wrecks can become powerful territorial attractors when they combine maritime narrative, accessibility, moderate depth, ecological colonisation and proximity to urban and port services. The Azorean case is therefore useful because it reveals both the attraction of wreck diving and the difference between accidental heritage wrecks and purpose-prepared artificial wrecks. The former may possess exceptional historical and symbolic value, but they also require careful protection, interpretation and regulation; the latter can be designed from the outset to support safer and more controlled recreational use.

These examples suggest that artificial wrecks and deliberately submerged structures should not be interpreted only as ecological devices. They also operate as territorial and entrepreneurial infrastructures. Their impact depends on the com-

bination of several factors: underwater singularity, preparation and environmental safety, depth compatibility with different certification levels, access by boat or from shore, proximity to dive centres, availability of emergency response, integration into destination branding, and governance mechanisms capable of regulating use intensity. In this sense, the value of a deliberately scuttled vessel is not contained exclusively in the object itself, but in the operational system that surrounds it. This distinction is fundamental. Natural or accidental wrecks often emerge from maritime disasters, wartime events, navigational failure or storm-related losses. They may be structurally unstable, partially collapsed, archaeologically sensitive, legally protected or environmentally hazardous. Their interiors can include silt, cables, nets, sharp metal, enclosed compartments and unpredictable collapse risks. By contrast, purpose-prepared artificial wrecks can mitigate many of these risks through prior cleaning, removal of hazardous materials, controlled openings, structural assessment, planned orientation, selected depth and post-sinking monitoring. They do not eliminate risk, since wreck diving always requires training, planning and conservative procedures, but they can transform an uncontrolled hazard into a managed underwater infrastructure.

2.3. Wreck Diving as a Specialised Tourism Product

Wreck diving is one of the most recognisable specialisations within recreational scuba diving. Its appeal lies in the combination of adventure, technical progression, maritime narrative, underwater spatiality and ecological observation. From the diver's perspective, a wreck is not perceived as a homogeneous seabed, but as a constructed object: bow, stern, deck, bridge, engine room, superstructure, openings, shadows, internal volumes and colonised surfaces. These elements generate a sequence of perception and movement that approximates an architectural experience, although one developed under conditions of neutral buoyancy. This spatial quality has clear tourism value. The dive can be narrated before and after it takes place. The operator can describe the route, show photographs, indicate the maximum depth, specify whether penetration is allowed or excluded, explain the vessel's history, identify expected marine fauna, define the required certification level and offer a clearly legible product. The wreck is therefore easily translated into commercial language: it is not merely a dive, but a wreck dive.

The literature on artificial wrecks has shown that deliberately scuttled vessels can generate local benefits through dive operations, associated tourism expenditure and destination differentiation (Genç, 2022; Morgan et al., 2009; Schaffer & Lawley, 2008). Other studies have examined diver preferences, showing that size, challenge, marine life, novelty and perceived uniqueness influence the attractiveness of wrecks (Seaman

& Depper, 2019; Stolk et al., 2005). Artificial reefs have also been analysed as recreational scuba-diving resources in their own right, with attention to how divers perceive, value and use them as alternatives or complements to natural dive sites (Stolk, 2007; Stolk et al., 2005). These findings support the idea that artificial wrecks can operate as tourism assets, provided that they are articulated with accessibility, safety, operators and governance.

2.4. Training & Entrepreneurship Value: The Wreck as a Submerged Classroom

An essential dimension of artificial wrecks is their training value. Wrecks enable technical progression because they combine depth, structure, orientation, buoyancy control and risk management within a single underwater environment. They are particularly suitable for developing competencies related to advanced diving, deep diving, underwater navigation, nitrox use, underwater photography, risk assessment, gas planning, emergency procedures and, where appropriate, controlled penetration under specific training conditions. This pedagogical role is also relevant from an environmental-management perspective, since diver training and briefing are among the main tools for reducing underwater impacts associated with contact, buoyancy problems, sediment disturbance and inappropriate behaviour (Edney & Spennemann, 2015; Sumanapala et al., 2022).



Figure 5: Become a PADI Wreck Diver, promotional flipchart for PADI's "Wreck Diver" specialty course.

Source: Professional Association of Diving Instructors (PADI) ©

From the perspective of scuba-diving education, a wreck provides a structured learning environment. Unlike an open rocky seabed, a vessel has recognisable limits, identifiable reference points and a spatial sequence that can be planned, briefed

and supervised. It allows the instructor to design a route briefing, establish a descent reference, define a maximum operating depth, set turn-pressure criteria, identify prohibited or restricted areas, plan a circumnavigation, avoid unauthorised

overhead environments, control group positioning and execute an ascent with an appropriate safety stop. The wreck is therefore not merely a recreational attraction, but a pedagogical and professionalisation device. This training dimension is directly linked to entrepreneurship. Certified courses generate higher added value than isolated recreational dives. They require instructors, classrooms, teaching materials, repeated sessions, specific equipment and structured customer follow-up. They also foster client retention: a diver who completes an advanced course may return for deep diving, nitrox, wreck diving, photography or technical-diving pathways. In this sense, the wreck forms part of a progressive training ladder rather than a one-off leisure product. It enables dive centres to convert a submerged asset into a sequence of educational services, specialised certifications and recurrent business opportunities.

But the success of a recreational wreck should not be measured solely by the number of divers or businesses it attracts, but by its capacity to become integrated into a sustainable model of coastal management. This includes prior decontamination, impact control, environmental monitoring, safety provisions, signage, mooring regulation, coordination among dive centres, local participation and the equitable distribution of benefits. The legal dimension adds a further layer of complexity. Moreu Ballonga (2025) demonstrates the density of the legal regime governing wrecks, particularly in relation to

historic shipwrecks, State vessels, treasure, ownership and underwater cultural heritage. In the case of *El Peñón*, this reference is especially useful for conceptually delimiting the object of study: it is not a historic archaeological wreck, but a contemporary artificial wreck, deliberately scuttled and managed as a recreational resource and artificial reef.

3. Conceptual Framework: Wreck-Based Blue Entrepreneurship

Wreck-based blue entrepreneurship is the process through which a wreck, particularly when deliberately scuttled as an artificial reef or recreational resource, acts as a catalyst for economic, educational, spatial and environmental value in a coastal or island territory. The conceptual key lies in understanding that an underwater object can operate as infrastructure when it enables repeated practices, services, training processes, mobility patterns, interpretation and governance. The proposed conceptual framework is structured around five interrelated dimensions: experiential singularity, operational accessibility, training value, entrepreneurial ecosystem and sustainable governance. These dimensions make it possible to analyse when a wreck is merely a submerged object, when it becomes a diving attraction, and when it reaches the condition of blue infrastructure.

Table 1
Conceptual dimensions of wreck-based blue entrepreneurship, from description to specific considerations on the case study.
Source: Authors.

Dimension	Description	Translation to the case of <i>El Peñón</i>
Experiential singularity	The wreck creates a differentiated, recognisable and narratable underwater experience.	<i>El Peñón</i> operates as an underwater landmark and as a specific wreck-diving product.
Operational accessibility	The resource becomes viable when safe access exists from shore or by boat, together with connectivity and urban support.	Shore entry from Tabaiba and proximity to Radazul reduce logistical costs and facilitate recurrent use.
Training value	Depth and structure enable advanced courses, deep diving, wreck diving, nitrox, orientation and safety training.	The 20–32 m profile allows routes to be segmented for Open Water, Advanced and Deep divers, with an emphasis on non-penetration except under specific training conditions.
Entrepreneurial ecosystem	The wreck generates greater value when embedded within a network of dive centres, clubs, instructors, services and operators.	The Radazul–Tabaiba axis concentrates dive centres, clubs and operators that use or market the surrounding underwater environment.

(continued on next page)

Table 1 (continued)

Dimension	Description	Translation to the case of <i>El Peñón</i>
Sustainable governance	Growth requires planning, safety, environmental monitoring and territorial return.	The coexistence of divers, bathers, boats and fishers requires buoyage, protocols and coordination.

The conceptual contribution of this article lies in shifting the analytical focus from the wreck as an object to the wreck as a node. This nodal interpretation is consistent with spatial approaches to coastal tourist territories in which the coastline is understood not as a fixed boundary, but as a relational interface between emerged territory, submerged support, social use and symbolic recognition (López Arquillo, 2023). It also resonates with marine spatial planning approaches that seek to organise uses, reduce conflicts and integrate environmental and economic functions in marine space (Douvere, 2008; Ehler & Douvere, 2009). A node is relevant because it concentrates relationships, not merely because it exists physically. In this sense, *El Peñón* can operate as an underwater centrality: a place beneath the sea that organises routes, products, memories, training activities and economic flows along the urban-marine edge.

On the basis of these dimensions, five propositions are formulated:

- The wreck fosters blue entrepreneurship because it creates a differentiated underwater experience that can be marketed as a wreck dive.
- Its shore-based accessibility and its connection with urban-coastal infrastructures increase its entrepreneurial value.
- Its depth and configuration enable advanced and specialised training products.
- Its effect is reinforced by the presence of operators, clubs, instructors and complementary services along the Tabaiba–Radazul axis and across the island of Tenerife.
- The sustainability of entrepreneurship based on *El Peñón* depends on safety, spatial regulation, environmental monitoring and coordination among stakeholders.

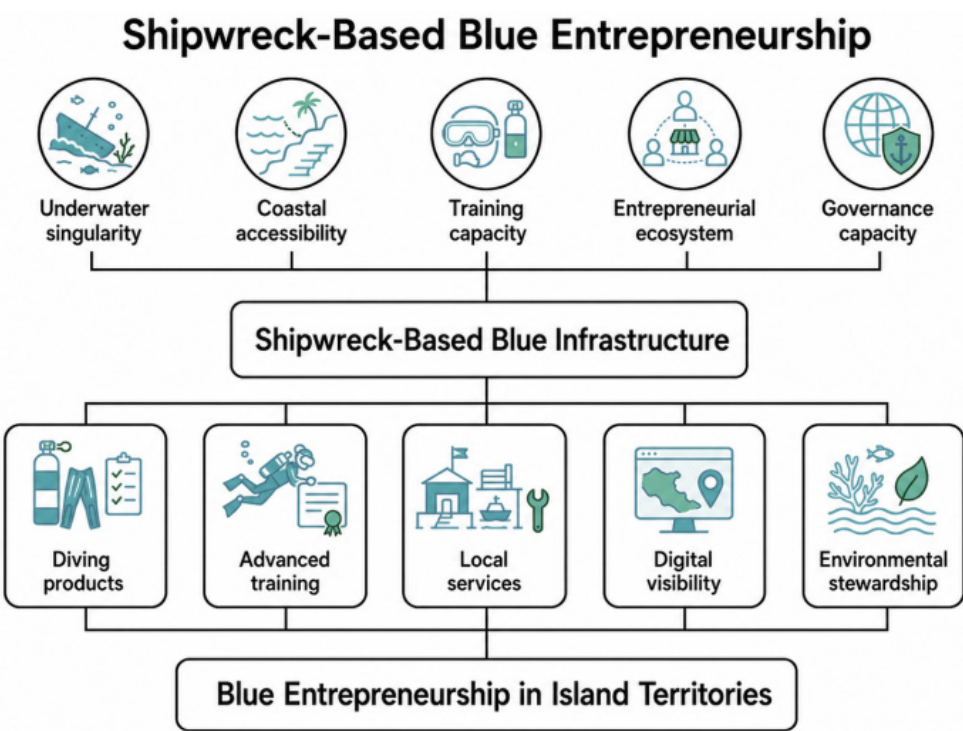


Figure 6: Wreck-Led Blue Entrepreneurship model. How a wreck ceases to be merely a sunken object and comes to function as wreck-based blue infrastructure, capable of activating blue entrepreneurship in island territories.

4. Case Study: *El Peñón* Wreck, Tabaiba, Tenerife

El Peñón is located off Tabaiba, in the municipality of El Rosario, on the eastern coast of Tenerife. It is a former tugboat deliberately scuttled in 2006 for the purposes of creating an artificial reef and a recreational dive site. Public descriptions place the wreck approximately between 20 and 32 m depth, with variations depending on the source and the specific dive route. Excel Scuba identifies it as a tugboat built at the Seville shipyards in 1958, with a length of 26.96 m, a beam of 7.70 m and a final sinking date of 11 July 2006. *El Peñón* should not

be interpreted as a historic archaeological wreck. Its value does not derive from antiquity or from heritage significance in the classical sense, but from its condition as a contemporary blue infrastructure. This clarification is important in order to avoid legal and conceptual confusion. The framework developed by Moreu Ballonga (2025) is useful for distinguishing the legal regime of historic wrecks from the case of a recent artificial wreck. *El Peñón* is a managed, contemporary wreck, functionally oriented towards recreational, training and environmental use.

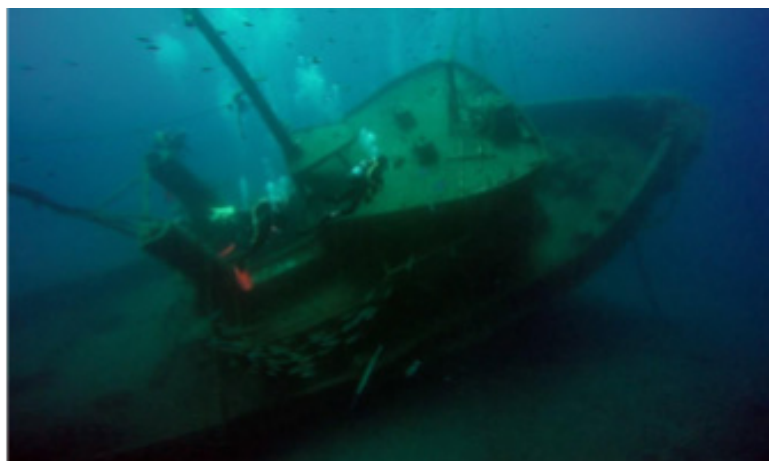
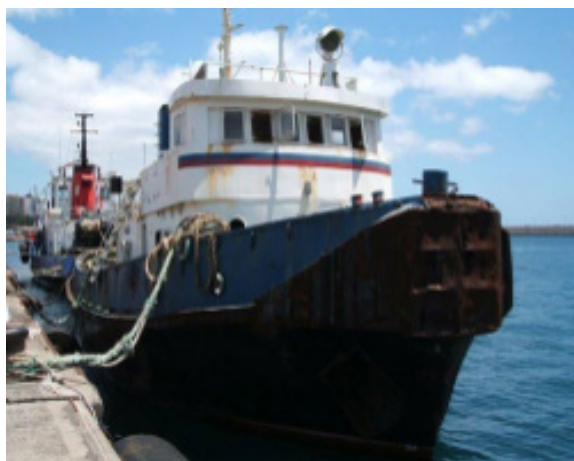


Figure 7: Images of *El Peñón* in 2004, prior to its controlled scuttling, and in 2018, similar to nowadays.

Source: José M. Peinado Martín.

The most relevant spatial characteristic of *El Peñón* is its shore-based accessibility. Many wrecks require a boat, harbour schedules, moorings, a skipper, fuel and favourable weather conditions. *El Peñón*, by contrast, can be integrated into a land-based diving operation. This reduces costs, allows greater flexibility, facilitates repeated training use and makes it possible for clubs and diving schools to use the site frequently. From the perspective of urban planning, the dive site does not begin underwater, but in the complete sequence of arrival, parking, equipment loading, briefing, sea entry, surface navigation, descent, underwater route, ascent, exit, rinsing of equipment and subsequent consumption in local services.

The Tabaiba–Radazul setting amplifies this value. Tabaiba provides the physical access point and the direct identity of the wreck. Radazul contributes marina facilities, nautical services, dive centres, food-and-beverage spaces and the condition of a metropolitan coastal node. Puerto Deportivo Radazul declares 202 berths, with a maximum vessel length of 20 m and a minimum draught of 4 m, in addition to associated harbour services (Puerto Deportivo Radazul, 2026). TITSA connects Santa Cruz with Tabaiba Baja and Radazul Bajo through line 138, and complements the area's accessibility with line 139 towards Playa La Nea and Tabaiba Baja (TITSA, 2026a, 2026b).

From a diving perspective, *El Peñón* allows several dive profiles. A complete profile around the hull, reaching depths close to 30–32 m, requires advanced planning, gas-consumption control, buoyancy mastery, monitoring of no-decompression limits and a safety stop. Scubanana Diving Center & tech diving School presents an Advanced/Deep route involving external circumnavigation of the hull at 28–31 m, with no penetration except for Wreck-trained divers, recommending nitrox and a torch, a referenced descent and small groups (Scubanana, 2026). PADI identifies the site as useful for Advanced Open Water Diver and Wreck Diver training pathways (PADI, 2026).

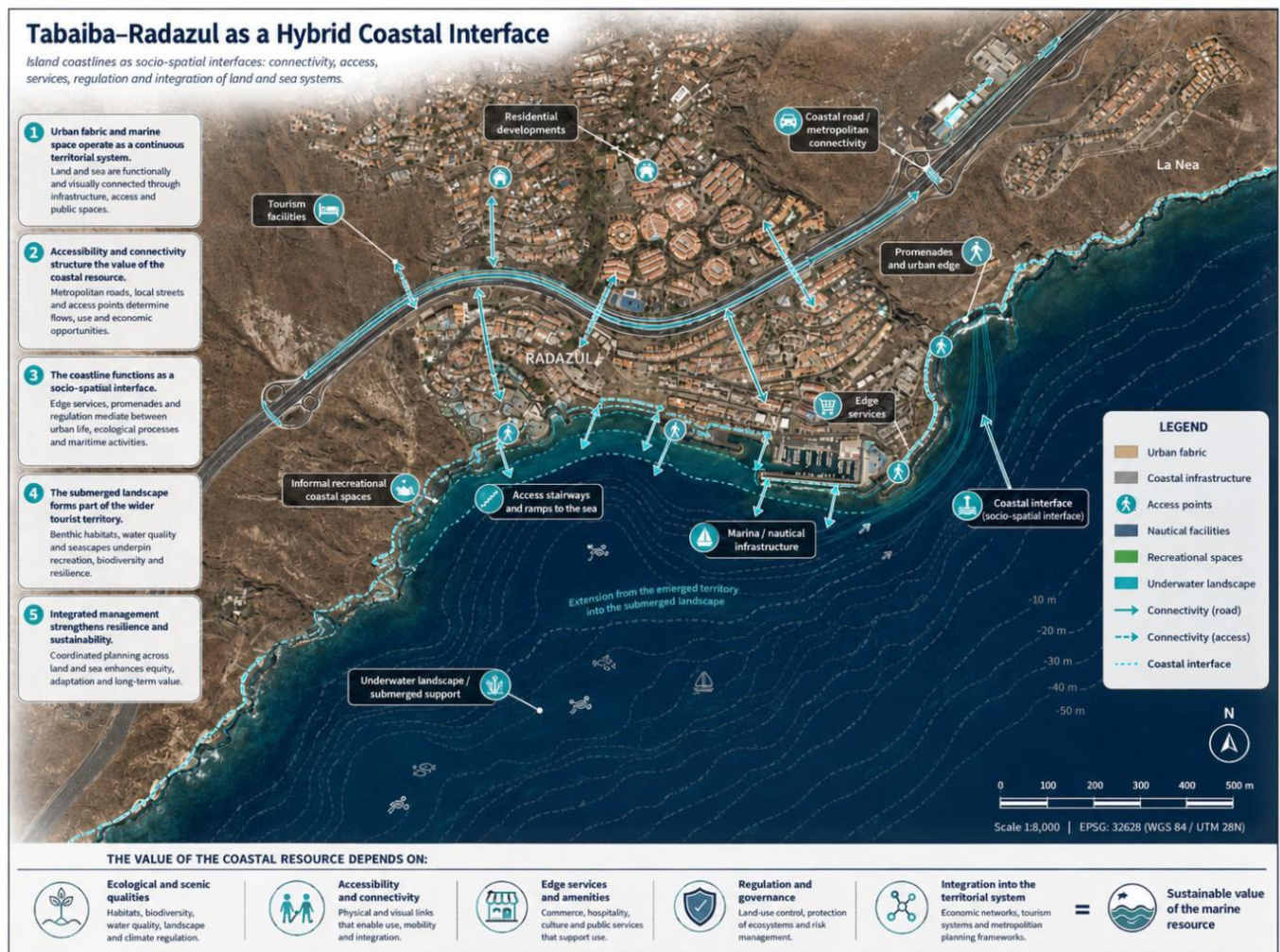


Figure 8: Tabaiba–Radazul as a Hybrid Coastal Interface. Conceptual coastal-planning map showing the Tabaiba–Radazul area as a hybrid socio-spatial interface between urban fabric, coastal infrastructure and submerged landscape. The figure illustrates how the value of a marine resource is not determined only by its ecological or scenic qualities, but also by accessibility, metropolitan connectivity, edge services, nautical infrastructure, regulatory capacity and integration into the wider territorial system.

5. Methodology

The study adopts an explanatory case-study design with light empirical validation based on indicators related to market structure, accessibility and territorial infrastructure. The selection of *El Peñón* as a case study is justified by its deliberate scuttling as an artificial reef, its shore-based accessibility, its integration into Tenerife's recreational diving offer and its proximity to the Tabaiba–Radazul axis, where a relevant concentration of underwater activities can be observed. This design is consistent with case-study research approaches in which a bounded empirical case is used to examine a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are analytically relevant (Flyvbjerg, 2006). It seeks to explain why an artificial wreck may foster processes of blue entrepreneurship and to verify whether the theoretical conditions identified in

the conceptual framework are observably present in the case of *El Peñón*. Empirical validation is therefore intentionally simple, transparent and replicable.

In order to strengthen the empirical grounding of the case study, the qualitative source triangulation was complemented with a contextual quantitative layer. This layer did not seek to measure the direct economic impact of *El Peñón* itself, nor to attribute tourism demand to the wreck. Instead, it was used to situate the case within the wider scuba-diving tourism system of Tenerife. Two types of quantitative sources were incorporated. First, official tourism-demand data from the Canary Islands Tourism Observatory / Promotur were used to identify the number of tourists undertaking scuba diving in Tenerife, their share within total tourism demand, average expenditure, average stay and estimated turnover. Second, the Register of Active Tourism Activities was processed to identify the number of formal scuba-diving activity registrations in Tenerife

and in the Canary Islands. These data were used as contextual indicators of demand and supply, complementing the qualitative evidence derived from dive-site descriptions, certification platforms, operator websites, cartography and territorial infrastructure sources.

The methodology is organised around the five propositions. For each proposition, a set of indicators is identified. Experiential singularity is validated through the presence of the wreck in dive-site catalogues, the use of terms such as *pecio*, wreck or artificial reef, photographs, route descriptions and references to marine fauna. Operational accessibility is analysed through shore-based access, proximity to the urban fabric, roads, bus lines, parking facilities, marina infrastructure and entry and exit points. Training value is examined through depth profile, certification requirements, Advanced, Deep, Wreck or Nitrox products, guided routes and non-penetration protocols. The entrepreneurial ecosystem is validated through the number of operators, years of activity, certifications, visible employment, services offered and digital presence. Governance is addressed through user conflicts, interaction between boats and divers, the need for buoyage, protocols, environmental monitoring and coordination among stakeholders. The main unit of analysis is the wreck as a submerged infrastructure. However, two secondary units are also considered. The first is the set of underwater operators active in the Tabaiba–Radazul area or marketing *El Peñón* as part of their diving offer. The second is the territorial support system that makes the resource usable: public transport, parking, marina facilities, coastal access, food-and-beverage services, equipment logistics and emergency-response capacity.

The spatial scope is divided into three scales. The first is Tabaiba, understood as the immediate coastal settlement and physical access point to the wreck. The second is Tabaiba–Radazul, interpreted as a functional micro-ecosystem of nautical and underwater activity. The third is Tenerife, incorporating operators from other parts of the island that include *El Peñón* in their dive portfolios. This multiscale reading is essential be-

cause the entrepreneurial effect of a dive site may exceed its immediate neighbourhood: a wreck may be local in its location but island-wide in its market.

The data sources are public and verifiable. The first group includes tourism websites, dive-site platforms, operator websites and certification platforms describing *El Peñón* and its diving profile. The second group includes corporate websites, legal notices, business directories and publicly available company information used to identify operators, years of activity, legal form and available labour data. The third group includes sources on accessibility and territorial infrastructure, such as public transport information, marina descriptions and references to parking provision. The fourth group includes journalistic and institutional sources on safety, regulation, accidents, user conflicts and coastal management. Validity is supported through source triangulation. A data point is considered more robust when it can be cross-checked across more than one type of source. For example, a description of a dive site is stronger when it appears both on a certification platform and in the offer of a diving operator. An accessibility indicator is more robust when it can be verified through transport timetables, cartography and local sources. Employment data are treated with caution because business directories may not be fully up to date and because part of the diving sector operates through self-employed professionals, clubs or seasonal collaborations.

The study has several limitations. First, publicly available data do not capture the full economic volume of underwater activity. Second, digital presence does not necessarily equate to actual turnover. Third, some operators may offer *El Peñón* without publishing detailed information. Fourth, the causal relationship between the 2006 scuttling and subsequent business activity cannot be demonstrated without a complete longitudinal series. Fifth, carrying capacity, ecological impact and diver behaviour would require specific underwater monitoring. These limitations do not invalidate the approach; rather, they define it as an explanatory and exploratory study based on observable indicators.

Table 2
Propositions, dimensions and indicators for empirical validation. It operationalises the conceptual framework by translating each analytical dimension into a set of observable indicators identified through public sources, operator information, dive-site descriptions, territorial infrastructure data and governance-related observations.

Propositions	Analytical dimension	Qualitative indicators	Contextual quantitative indicators
P1	Experiential singularity	Presence of wreck in catalogues; route descriptions; photos; artificial reef references.	Number and share of tourists undertaking scuba diving in Tenerife.

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Table 2 (continued)

Propositions	Analytical dimension	Qualitative indicators	Contextual quantitative indicators
P2	Operational accessibility	Shore access; public transport; parking; marina; entry/exit points.	Not directly quantified; supported by territorial and infrastructure data.
P3	Training value	Depth; Advanced/Deep/Wreck/Nitrox; protocols; guided routes.	Expenditure, stay and daily spending of scuba-diving tourists as proxy for specialised tourism segment.
P4	Entrepreneurial ecosystem	Operators; clubs; services; digital presence; certifications.	Number of registered scuba-diving active-tourism activities in Tenerife and Canary Islands; estimated turnover of scuba-diving tourist segment.
P5	Governance	User conflicts; safety protocols; monitoring; coordination.	Not directly quantified; future work should combine carrying capacity, diver pressure and ecological monitoring.

6. Data Analysis and Results

6.1. *El Peñón* as an Experiential Underwater Landmark

The first proposition is supported by the way in which *El Peñón* is described and marketed. The wreck appears as a differentiated product rather than as a generic underwater location. Its identity as a wreck is central to its attractiveness. The term *pecio* or *wreck* is not incidental; it defines the experience. PADI presents it as a wreck located only a few metres off the coast of Tabaiba and sunk at a depth of 30 m, with training relevance for advanced and wreck diving (PADI, 2026). Promotur Turismo de Canarias describes it as a vessel sunk in 2006 to enrich marine life and promote scuba diving (Promotur Turismo de Canarias, 2026).

From a spatial perspective, *El Peñón* operates as an underwater landmark. In urban planning, landmarks help structure perception and orientation; they are recognisable points that organise mental maps. Underwater, where visibility, buoyancy and orientation are governed by conditions different from those on land, a wreck performs a comparable function. It becomes a destination, a descent reference, a route generator and a memorable object. The diver does not merely dive in Tabaiba; the diver dives *El Peñón*. This landmark condition is reinforced by the morphology of the vessel. Hull, deck, superstructure, list, openings and tugboat elements generate a legible spatial sequence. The exterior route can be planned as a circumnavigation. The maximum depth can be clearly defined. The ascent can be organised through references and group

control. The wreck therefore provides spatial legibility, a factor that is essential both for safety and for tourism narration. The commercial value of this singularity is evident. Operators can present the dive as one of Tenerife's reference wreck-diving sites. They can use photographs, route descriptions, certification requirements and expected marine life. The dive becomes a named product, rather than an undifferentiated location.

6.2. Shore-Based Accessibility and Urban-Coastal Integration

The second proposition is also supported. Shore-based accessibility is one of the strongest entrepreneurial attributes of *El Peñón*. A wreck accessible from land differs substantially from one that requires a boat. Shore entry reduces costs, increases timetable flexibility, enables repeated use, facilitates training and lowers barriers for local divers, clubs and diving schools. This condition turns the wreck into a recurrent operational resource.

From an urban-planning perspective, the dive site is not located only underwater. It begins on land. The user arrives by car, bus or dive-centre vehicle; prepares the equipment; transports cylinders and weights; receives the briefing; enters the sea; navigates on the surface or descends using a reference; completes the dive; performs a safety stop; exits the water; rinses the equipment and, frequently, consumes nearby local services. This sequence constitutes an amphibious itinerary. The quality of the diving product depends on the land-sea continuity of that itinerary. In Tabaiba-Radazul, several ter-

territorial factors reinforce this itinerary: road connectivity, proximity to the Santa Cruz metropolitan area, public transport lines, marina facilities, coastal access points and the presence of operators. TITSA identifies line 138 as connecting Santa Cruz, Tabaiba Baja and Radazul Bajo, and line 139 as serving Playa La Nea and Tabaiba Baja (TITSA, [2026a](#), [2026b](#)). This connectivity makes it possible to interpret the wreck within a framework of metropolitan accessibility, rather than merely as a recreational enclave dependent on private cars.

Parking is another relevant territorial variable, although it should be measured more precisely in future phases. The availability of parking supports the operation of dive centres and visiting divers, but it may also become a carrying-capacity constraint. Diving equipment is heavy and bulky; the distance between parking and the entry point directly affects the usability of the site. Parking is therefore not a secondary convenience, but part of the operational capacity of the blue infrastructure. The marina at Radazul adds an additional layer. Although *El Peñón* is mainly used from shore, the marina contributes to the nautical identity of the area and provides complementary services. Its 202 berths, maximum vessel length of 20 m and associated services reinforce Radazul's condition as a coastal node rather than a simple residential edge (Puerto Deportivo Radazul, [2026](#)). P2 is thus supported: accessibility and infrastructural integration increase the entrepreneurial capacity of the wreck.

6.3. Training Value, Technical Profile and Product Segmentation

The third proposition is supported by the depth and configuration of the wreck. *El Peñón* is located within a range that allows recreational levels to be segmented. The upper parts can be observed through limited profiles under supervision, while a complete route around the hull, at approximately 28–31 m, requires advanced planning. This condition makes it a valuable teaching resource.

From the perspective of a wreck-diving instructor, *El Peñón* allows several pedagogical profiles to be designed. In Advanced Open Water, it can be used for a deep adventure dive, orientation tasks, buoyancy control and planning. In Deep Diver training, it allows work on gas management, depth awareness, discussion of narcosis, ascent control and safety-stop discipline. In Wreck Diver training, it enables external recognition, risk identification, route planning, discussion of reel or line use, non-penetration briefing and, only with appropriate training, overhead-environment practice. In Nitrox training, it allows discussion of maximum operating depth, oxygen exposure and the extension of no-decompression limits within recreational parameters. Scubanana Diving School describes an Advanced/Deep route involving exterior circumnavigation of the hull at 28–31 m, with no penetration except for Wreck-trained divers, recommending nitrox and a torch, a referenced

descent and a safety stop (Scubanana, [2026](#)). This type of description shows the conversion of the wreck into a technical and training product. It is not an unstructured recreational dive, but a practice organised by level, depth, procedure and risk control.

This dimension generates entrepreneurial value because training products are more complex and higher-value than an isolated recreational dive. They require an instructor, teaching materials, a classroom, repeated sessions, equipment, insurance and follow-up. They also foster customer retention. A diver may first encounter the upper part of the wreck, return for an advanced course, complete a deep dive, undertake nitrox training and subsequently progress into wreck diving. *El Peñón* thus acts as a training ladder and as a support for professionalisation. P3 is therefore supported.

6.4. Entrepreneurial Ecosystem and the Functionality of the Urban Zone.

The fourth proposition concerns the existence of an entrepreneurial ecosystem. Publicly available evidence shows that *El Peñón* is embedded within a broader environment of diving and nautical activity. In Tabaiba, Radazul and at the island scale, there are clubs, PADI centres, SSI centres, operators with retail facilities, training provision, rental services, cylinder filling and guided-dive offers. Some actors are physically located along the axis; others operate from different parts of Tenerife but include *El Peñón* in their dive portfolios. Club de Buceo El Pejín presents a direct connection with Tabaiba and with the history of the wreck's sinking, highlighting the role of Manolo Beltrán, an instructor from the club, as a promoter of the initiative that allowed the vessel to be visited by scuba divers (Club de Buceo El Pejín, 2026). Scubanana appears on PADI with an address on Avenida Colón, Puerto Deportivo Radazul, and offers PADI courses and guided dives (PADI, [2026c](#)). Macaron Divers, Diving Canarias specifically markets the *El Peñón* wreck in Open and Advanced versions, with shore-based routes. Other non-profit clubs and collectives also operate in the area, likewise using the wreck as a target for their advanced dives.

The following table summarises the preliminary validation matrix. It should not be understood as a complete census, but as evidence that the wreck does not operate in isolation, but within an ecosystem of actors, services and scales.

Table 3

Matrix of actors linked to the Tabaiba–Radazul underwater ecosystem, related to evidences.

Actor / entity	Spatial relationship	Type of actor	Observable evidence	Relevance for <i>El Peñón</i>
Club de Buceo El Pejín	Tabaiba	Diving club / diving school	Public presence and connection with the sinking (this club promoted the sinking)	Reinforces local identity, diving culture and community appropriation of the resource.
Scubanana diving School & Tech Diving	Puerto Deportivo Radazul	PADI centre / company	PADI lists its address on Avenida Colón, Puerto Deportivo Radazul, and its provision of courses and dives.	Connects the wreck with the marina economy, PADI courses and island-wide guiding services.
Diving Canary Islands	Radazul	Island-based centres or operators	Public offer of dives in Radazul and other dive sites in Tenerife.	Expands the island-wide reach of the underwater ecosystem.
CBU Tenerife	Radazul	PADI club	Public presence centered in University ecosystem	Research-based operations in the wreck
Macaron Diver	Radazul	Island-based centres or operators	Publishes specific Open and Advanced routes for the <i>El Peñón</i> wreck.	Directly markets the wreck as a guided and training-oriented product.
Non-profit and collectives	Puerto Deportivo Radazul	Clubs	Non-profit courses and low-level facilities	Local divers underwater ecosystem.
External operators from	Island scale	Commercial operators	Include <i>El Peñón</i> in dive portfolios or wreck-diving routes.	Transform the local resource into an island-destination product.

The value of this table is not to demonstrate direct business causality, but to evidence structure. *El Peñón* is not an isolated attraction; it forms part of a network of operators with diverse profiles. Some are proximity-based actors, while others operate at the island scale. This dual condition reinforces the propositions that the wreck produces value both for Tabaiba and for Tenerife's wider underwater tourism offer. The existence of instructors, guides, retail services, equipment rental, cylinder filling, courses and active operators demonstrates a professional service economy. P4 is therefore reasonably supported.

The interpretation of the Tabaiba–Radazul diving envi-

ronment as an entrepreneurial ecosystem is consistent with approaches that understand entrepreneurship as embedded in territorial configurations of actors, infrastructures, institutions, markets and support services rather than as the isolated action of individual firms (Isenberg, 2010; Stam, 2015; Spigel, 2017).

6.5. Contextual quantitative evidence: scuba-diving demand and registered active-tourism supply in Tenerife

The qualitative interpretation of *El Peñón* as a potential catalyst for blue entrepreneurship can be reinforced through contextual quantitative evidence. Official data from the Canary Islands Tourism Observatory / Promotur show that 168,933 tourists aged 16 or over undertook scuba diving during their stay in Tenerife in 2025, representing 2.6% of the island’s tourist population in that age group. This confirms that scuba diving is not a marginal or anecdotal activity, but a measurable specialised segment within the island’s tourism system. (Instituto Canario de Estadística, 2026). The same source reports that tourists undertaking scuba diving had an average expenditure per trip of €1,367, an average stay of 8.8 days and an average daily expenditure of €170.59. When flights are excluded, average daily expenditure remains €126.98, which is especially relevant for interpreting the territorial capture of value through accommodation, food and beverage, mobility, training, equipment rental, guiding and other local services.

At the economic scale, the estimated total turnover associated with tourists undertaking scuba diving in Tenerife reached €231 million in 2025, or €174 million when excluding flights. These values should not be interpreted as direct expenditure on diving centres, nor as the economic impact of *El Peñón*.

Rather, they indicate that diving tourists participate in a wider expenditure system that connects marine activities with the broader destination economy. At the regional scale, 405,575 tourists undertook scuba diving in the Canary Islands in 2025. Tenerife therefore accounted for approximately 41.7% of the regional scuba-diving tourist segment. This reinforces the relevance of Tenerife as one of the main islands in the Canary Islands for this specialised tourism activity (Instituto Canario de Estadística, 2026). The supply-side context also supports this interpretation. Processing the Register of Active Tourism Activities shows 269 scuba-diving activity registrations in the Canary Islands, of which 102 correspond to Tenerife. This represents approximately 37.9% of registered scuba-diving activity entries in the archipelago. Within Tenerife, scuba diving accounts for around 9.0% of all active-tourism activity registrations. Although these figures refer to activity registrations and not necessarily to unique firms or effective annual activity, they confirm the existence of a formalised supply base capable of supporting recreational diving, training, guiding and related services. In this context, *El Peñón* should be interpreted not as an isolated attraction, but as a specialised underwater asset inserted into a measurable demand segment and a registered active-tourism supply system.

Table 4
Contextual quantitative indicators for scuba-diving tourism and active-tourism supply in Tenerife. Tourism-demand and expenditure indicators are taken from the 2025 tourist profile by activities undertaken at destination for Tenerife (Observatorio Turístico de Canarias, 2026b). The Canary Islands comparison is based on the regional activity profile (Observatorio Turístico de Canarias, 2026a). Active-tourism supply indicators are based on the Register of Active Tourism Activities (Gobierno de Canarias, 2026). Tenerife’s 41.7% share of the regional scuba-diving tourist segment is an author calculation.

Dimension	Indicator	Value	Interpretation for the case study
Tourism demand	Tourists aged 16+ in Tenerife	6,443,553	Reference universe of island tourism demand.
Tourism demand	Tourists undertaking scuba diving	168,933	Scuba diving is a measurable specialised tourism segment.
Tourism demand	Share of scuba-diving tourists	2.6%	It is a niche activity, but statistically visible.
Tourist expenditure	Average expenditure per trip	€1,367	Indicates relevant economic profile.
Tourist expenditure	Average stay	8.8 days	Supports interpretation as part of a complete stay.

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Table 4 (continued)

Dimension	Indicator	Value	Interpretation for the case study
Tourist expenditure	Average daily expenditure	€170.59	Shows spending capacity of the segment.
Territorial expenditure	Average daily expenditure excluding flights	€126.98	Approximates expenditure more capturable in destination.
Economic relevance	Estimated total turnover	€231 million	Indicates economic significance of the scuba-diving tourist segment.
Economic relevance	Estimated turnover excluding flights	€174 million	Approximates territorial economic relevance.
Regional position	Scuba-diving tourists in Canary Islands	405,575	Regional comparison.
Regional position	Tenerife share of Canary Islands scuba-diving tourists	41.7%	Tenerife concentrates a major part of the regional segment.
Formal supply	Registered scuba-diving active-tourism activities in Canary Islands	269	Formal supply base at regional level.
Formal supply	Registered scuba-diving active-tourism activities in Tenerife	102	Formal supply base at island level.
Formal supply	Tenerife share of registered scuba-diving activities	37.9%	Tenerife has a significant share of registered supply.

6.6. Governance, Safety and Spatial Conflict

The fifth proposition is the most important for evaluating the sustainability of the model. The same factors that make *El Peñón* a valuable resource—accessibility, popularity, proximity to the shoreline and concentration of uses—also generate governance challenges. The Tabaiiba–Radazul coastline is a shared space used by divers, bathers, boats, fishers, paddle-board users, residents, visitors and marina users. Underwater entrepreneurship does not take place in an empty sea; it depends on a common public space in which uses overlap both vertically and horizontally. From a spatial-planning perspective, this is a classic problem of carrying capacity and compatibility of uses. A dive site may be environmentally and commercially successful, yet spatially fragile. The more accessible it is, the more governance it requires. Buoyage, vessel-speed control, surface-marker-buoy protocols, designated entry and exit

points, compulsory briefings, coordination among operators and emergency access are planning instruments, not merely operational details.

From the perspective of diving safety, *El Peñón* requires disciplined procedures: verification of certification level, briefing of the dive profile, definition of maximum operating depth, turn-pressure criteria, no-decompression control, safety stop, group control, a no-touch policy, prohibition of penetration except under specific training conditions, use of a surface marker buoy where appropriate and attention to surface traffic. These protocols are not only diving techniques; they are instruments for governing a public marine space.

Environmental governance is also necessary. The fact that the wreck attracts marine life does not automatically mean that it produces net conservation benefits. Castro et al. (2025) warn against oversimplified conservation narratives regarding artificial wrecks. Operators should integrate environmental

briefings, contact control, respect for fauna, no-feeding rules, no-extraction rules and photographic or citizen-based monitoring. The resource must be monitored, not merely exploited. P5 is therefore confirmed as a necessary condition. The entrepreneurial value of *El Peñón* is sustainable only if it is

supported by governance. The wreck should not be managed as a free-access attraction without rules, but as a shared blue infrastructure requiring stewardship, safety and territorial return.

Table 4

Empirical validation of the propositions through observable indicators and verifiable evidence links. The table translates the five proposition into public, verifiable indicators and summarises the evidence identified in the case of *El Peñón*. The validation does not measure total economic impact, but assesses whether the conditions for shipwreck-based blue entrepreneurship are present in the Tabaiba–Radazul case.

Prop.	Analytical dimension	Observable indicators	Evidence identified in the case of <i>El Peñón</i>	Verifiable evidence links	Interpretation
P1	Experiential singularity	Presence of the wreck in dive-site catalogues; use of terms such as wreck, pecio or artificial reef; photographs; route descriptions; references to marine fauna; recognition as a named dive site.	<i>El Peñón</i> is repeatedly described as a recognised wreck dive located only a few metres off the coast of Tabaiba and sunk at approximately 30 m. Scubanana presents the Tabaiba wreck as Tenerife's true wreck-diving experience and as a deliberately sunk tugboat from 2006, intact and recognisable as a ship.	PADI: El Peñón dive site Hello Canary Islands: Tabaiba dive point Excel Scuba: Dive site Tabaiba Scubanana: Tabaiba wreck discussion	The wreck operates as an underwater landmark. Its value lies in its recognisable morphology, narrative identity, artificial-reef condition and capacity to be translated into a marketable wreck-diving product.
P2	Operational accessibility	Shore-based access; proximity to the urban fabric; metropolitan road connection; public transport; parking provision; marina infrastructure; entry and exit points; relationship with edge services.	<i>El Peñón</i> is accessible from the Tabaiba shoreline, reducing dependence on boat logistics and allowing recurrent use by clubs, instructors and dive centres. The Tabaiba-Radazul axis is connected to Santa Cruz by TITSA lines 138 and 139. Radazul provides complementary nautical infrastructure, including a marina with approximately 202 berths, vessel services and a consolidated urban-coastal edge.	PADI: El Peñón dive site TITSA line 138 TITSA line 139 Puerto Deportivo Radazul SITCAN / GRAFCAN territorial viewer	Shore access, metropolitan connectivity and Radazul's nautical infrastructure increase the operational value of the wreck. Parking, entry-point congestion and equipment-carrying distances remain local capacity variables that should be assessed through fieldwork.

(continued on next page)

Table 5 (continued)

Prop.	Analytical dimension	Observable indicators	Evidence identified in the case of <i>El Peñón</i>	Verifiable evidence links	Interpretation
P3	Training value	Depth profile; certification requirements; Advanced, Deep, Wreck or Nitrox products; guided routes; no-penetration protocols; referenced descent; safety stop; segmentation by diver level.	The wreck is located within a depth range generally described between 20 and 32 m. PADI identifies the site as requiring at least Advanced Open Water Diver level and as relevant for Wreck Diver training. Scubanana's wreck-diving training offer explicitly covers navigation and orientation around wrecks, structural assessment, safety procedures, reel and guideline techniques and controlled penetration.	PADI: El Peñón dive site Scubanana: wreck diving course Scubanana: PADI dive center profile CBUT: safety and training approach Excel Scuba: Wreck and Deep specialties	<i>El Peñón</i> functions as a submerged classroom. Its depth, morphology and route legibility allow segmentation into advanced, deep and wreck-related training products, generating higher added value than an isolated recreational dive.
P4	Entrepreneurial ecosystem	Number and type of operators; certifications; visible team or club information; services offered; digital presence; relation to Radazul-Tabaiba; evidence of training, guiding and community-based diving activity.	The entrepreneurial and community ecosystem is evidenced by different diving centres. These actors show that the wreck is embedded not only in commercial diving, but also in educational, community and university-linked diving practices.	Scubanana: Tabaiba wreck discussion El Pejín Diving Club Apnea canarias Diving Canarias Macaronesian Divers Quimera Sub (only the located in Radazul and Tabaiba coastal zone are shown)	The wreck is embedded in a functional diving ecosystem centred on Scubanana and CBUT in Radazul. The evidence supports a structural reading of local blue entrepreneurship and community-based underwater activity, without claiming that the 2006 scuttling directly caused the creation of each actor.
P5	Governance and sustainability	Interaction between divers, boats, bathers and other coastal users; need for safety protocols; certification checks; surface-	The Tabaiba-Radazul coast is a multi-use public coastal space where diving activity coexists with bathing, recreational boating,	PADI: El Peñón qualification requirement Scubanana: wreck-diving safety and course content	The entrepreneurial value of the wreck is sustainable only if accompanied by governance. The available

(continued on next page)

Table 5 (continued)

Prop.	Analytical dimension	Observable indicators	Evidence identified in the case of <i>El Peñón</i>	Verifiable evidence links	Interpretation
		marker procedures; no-penetration rules; environmental briefings; coordination among operators, clubs and authorities; environmental monitoring.	marina activity, fishing, paddle use and residential/tourist visitation. Governance evidence is therefore addressed through operational and educational sources. These sources support governance as a necessary condition, while detailed buoyage, carrying capacity and institutional coordination require fieldwork and official verification.	CBUT: safety, laws and marine-environment commitment Puerto Deportivo Radazul SITCAN / GRAFCAN territorial viewer	public evidence supports the need for safety, training, environmental responsibility and coordination, but detailed claims about conflict, buoyage or enforcement should be supported by official or field-based sources.

7. Discussion

The analysis presented of *El Peñón* supports the central argument of this article: artificial wrecks can foster blue entrepreneurship in island territories when they operate as small-scale blue infrastructures embedded within a coastal system. Their value does not reside solely in the submerged vessel, but in the interaction between underwater singularity, shore-based accessibility, training pathways, entrepreneurial ecosystem and governance.

The first issue for discussion is spatial centrality. *El Peñón* creates a form of underwater centrality. In urban planning, centrality emerges when a place concentrates flows, functions, meanings and services. The wreck performs an analogous role beneath the surface. It concentrates dives, courses, digital attention, operator products and territorial identity. It becomes a node within Tenerife's underwater geography. The second issue is land–sea continuity. Traditional urban planning often stops at the coastline, while marine spatial planning frequently begins offshore. Dive sites demonstrate that this separation is inadequate. The diving experience is amphibious: it begins in the urban realm, continues through roads and parking areas, crosses the coastal edge, enters the water column, reaches the seabed and returns to land. For this reason, wreck-based entrepreneurship must be analysed through the continuity of the urban-coastal interface. The third issue is the productive role of technical knowledge. Wreck-based entrepreneurship depends on expertise. It requires instructors, guides, safety protocols, certification systems, gap planning, environmental

sensitivity and local knowledge of site conditions. This distinguishes it from more passive forms of coastal tourism. A beach can be consumed with minimal mediation; a wreck requires professional mediation. That mediation creates qualified employment and training opportunities. The fourth issue concerns the relationship between artificial reefs and conservation narratives. The fact that a wreck is colonised by marine life does not automatically mean that it constitutes a conservation strategy. Castro et al. (2025) rightly question simplified narratives that present any artificial wreck as an ecological benefit. In the case of *El Peñón*, this article therefore avoids claiming that the wreck is intrinsically beneficial for the ecosystem. What is argued is that its entrepreneurial legitimacy depends on environmental monitoring and stewardship of the resource. Kirkbride-Smith et al. (2016) analyse artificial reefs in marine protected areas and show that they can provide habitat for biodiversity observation and generate user-derived revenues, but only within a management framework. The fifth issue is the risk of spatial inequality. If the benefits generated by the wreck are captured by a limited number of operators while risks, conflicts and environmental pressures fall upon the public realm, the model becomes weak. Responsible blue entrepreneurship requires local return. This may take the form of environmental education, cooperation among operators, information panels, school activities, citizen science, municipal coordination, contributions to safety, good-practice campaigns and maintenance of access points. The sixth issue is replicability. The case of *El Peñón* cannot be mechanically translated into the idea of scuttling more vessels along any coastline. It works because

several conditions coincide: a tourism-oriented island, a diving culture, an accessible coastline, nearby operators, marina facilities, metropolitan proximity, recognised underwater value and the capacity for territorial integration. Other territories considering artificial wrecks should first assess whether these conditions exist. Scuttling a vessel without accessibility, operators, governance or monitoring may create a problem rather than an asset.

These data reposition the case of *El Peñón* within a wider tourism-demand framework. The wreck is not analysed in an abstract recreational context, but within an island destination where scuba diving is a measurable activity involving 168,933 tourists and an estimated turnover of €231 million. This does not mean that *El Peñón* explains this demand. Rather, it means that the wreck is inserted into a destination where scuba diving already has statistical presence, expenditure capacity and business relevance. Consequently, the contribution of the case lies in showing how a specific artificial wreck can help structure part of this wider segment through accessibility, training, operator networks and territorial integration.

8. Conclusions

This article asked how an artificial wreck can act as a catalyst for blue entrepreneurship in an island territory. The case of *El Peñón* shows that this process is not explained by the physical presence of the wreck alone, but by the interaction between underwater singularity, shore-based accessibility, training capacity, entrepreneurial ecosystem development, contextual tourism demand and governance requirements.

Artificial wrecks should be understood as small-scale blue infrastructures located at the intersection of marine ecology, tourism planning, maritime safety and local entrepreneurship. They create new underwater centralities, support specialised dive products, extend the portfolio of coastal destinations and provide dive centres with stable nodes of interest around which courses, guided dives, photographic itineraries and advanced training programmes can be organised. Their relevance is therefore not only environmental or recreational, but also spatial, economic and territorial. The main contribution of the article is both conceptual and methodological. Conceptually, it reframes artificial wrecks as small-scale blue infrastructures. Methodologically, it shows that the entrepreneurial role of a wreck can be analysed through simple but meaningful indicators: operators, years of activity, certifications, visible employment, public transport, harbour infrastructure, parking provision, commercial products and governance issues. These indicators do not replace detailed economic or ecological studies, but they provide a practical pathway for assessing whether a wreck functions as a territorial resource. When properly integrated, it can operate as a blue infrastructure connecting underwater tourism, advanced training, local services, harbour systems, coastal accessibility and maritime identity. The case

shows why artificial wrecks can foster blue entrepreneurship in island territories, but also why such entrepreneurship must be planned, regulated and monitored. Future research should extend this framework through comparative and longitudinal approaches. In particular, the methodology proposed in this article could be applied through a contrastive case-study method to other artificial wrecks in island and coastal contexts such as Malta, Madeira, the Azores, Cyprus, the Balearic Islands or other sites within the Canary Islands. This interpretation is consistent with research on artificial reefs and diving tourism (Ramos, 2024; Stolk, 2007), with economic assessments of artificial wreck reefs (Genç, 2022), and with marine spatial planning approaches that emphasise coordination, monitoring and ecosystem-based management (Douvere, 2008; Ehler & Douvere, 2009).

This article has analysed the application of the methodology on the wreck of *El Peñón*, in Tabaiba, Tenerife, as a case study for understanding how artificial wrecks can contribute to blue entrepreneurship in island territories. The paper has proposed the concept of wreck-based blue entrepreneurship to describe the process through which a deliberately scuttled vessel becomes a catalyst for tourism, training, business activity, territorial identity and environmental stewardship. The analysis provides reasoned support for the propositions formulated: the wreck generates experiential singularity: it is not a generic dive, but a recognised wreck with spatial, narrative and photographic value, with a shore-based accessibility and its integration into the Tabaiba–Radazul system increase its operational value. Besides, its depth and configuration enable advanced and specialised training products for dive centres, clubs, instructors and services. Finally, its sustainability depends on governance, maritime safety, environmental monitoring and coordination among users.

The revised analysis also incorporates contextual quantitative evidence that strengthens the interpretation of *El Peñón* as a potential catalyst for blue entrepreneurship. Official tourism data show that scuba diving is a measurable specialised segment in Tenerife, involving 168,933 tourists in 2025 and an estimated turnover of €231 million. In addition, the Register of Active Tourism Activities identifies 102 scuba-diving activity registrations in Tenerife, confirming the existence of a formal supply base. These data do not demonstrate direct causality between *El Peñón* and tourism demand, but they show that the wreck is embedded in an island tourism system where diving has demand, expenditure and entrepreneurial structure. This reinforces the article's main contribution: artificial wrecks may operate as small-scale blue infrastructures when they connect a distinctive underwater asset with a real market, formal operators, training pathways, coastal accessibility and governance capacity. The case of *El Peñón* also shows that blue entrepreneurship should not be confused with unlimited growth. The success of a dive site may generate pressure, conflict and risk. Entrepreneurship must therefore be linked to

stewardship. A wreck generates value only if the marine space remains safe, ecologically monitored and socially legitimate. In this sense, the future of *El Peñón* as a blue infrastructure depends not only on diving demand, but also on planning capacity.

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Visiting the Tabaiba Wreck: <https://www.youtube.com/watch?v=bRVhouUTKZ8>

Ethical Statement

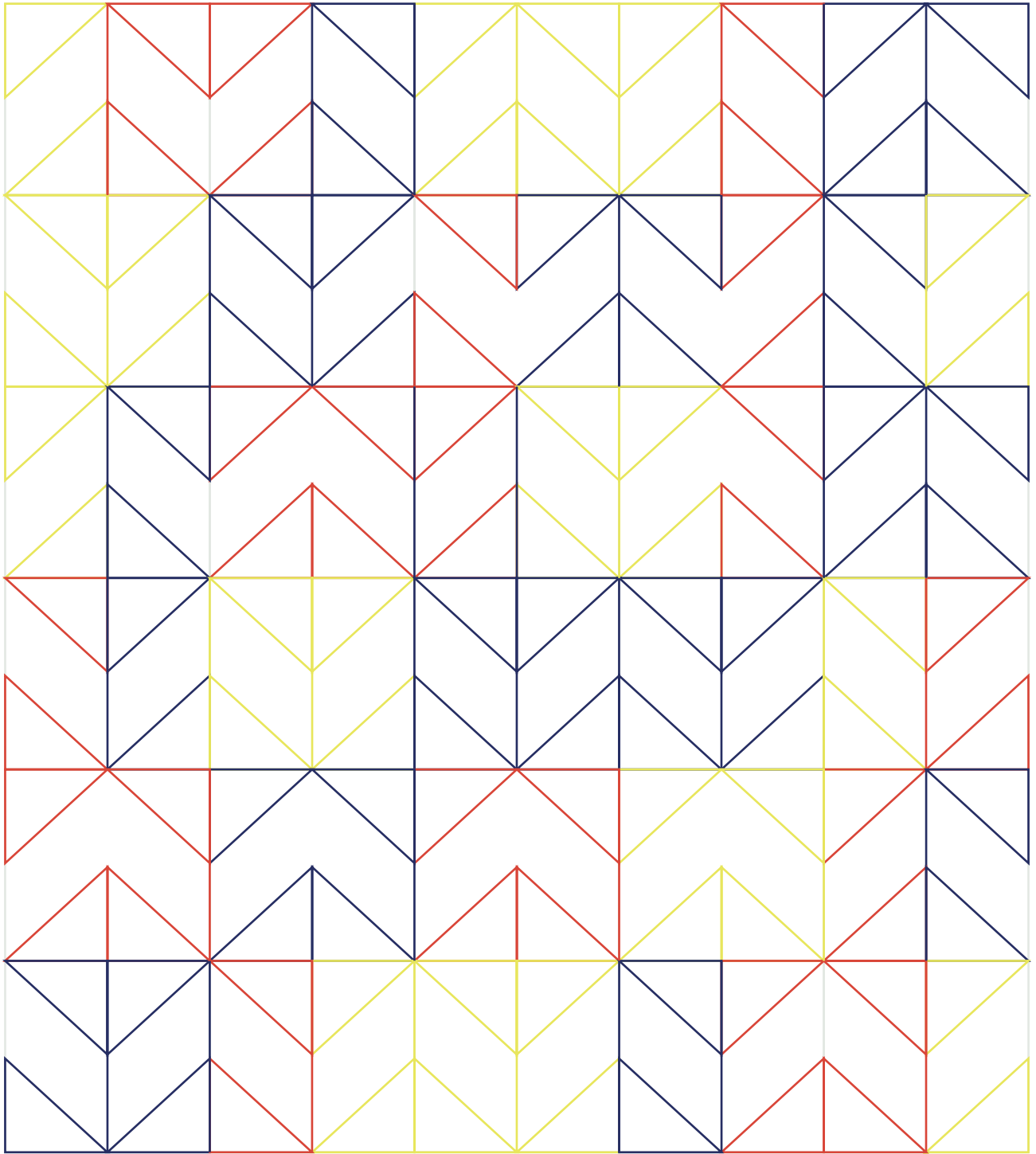
Peer Review: Single-blind.

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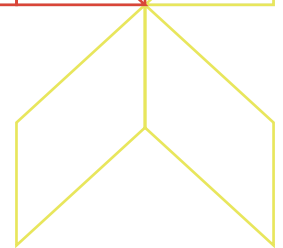
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