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Fostering Resilience and Innovation in Island Communities – Identifying Systemic Challenges and Opportunities

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ABSTRACT

This paper explores how stakeholders in island communities perceive and address systemic challenges to resilience and innovation in the context of the green transition and broader societal change. Drawing on insights from the Interreg FREIIA project – a multi-country, participatory initiative across six European islands – this study employs a design thinking framework and grounded theory methodology to explore how local stakeholders perceive and respond to development challenges, highlighting the voices and lived experiences of island residents and aiming to understand the realities on the ground and the multidimensional conditions shaping resilience and innovation in their communities.

The findings highlight recurring development challenges, including youth outmigration, housing shortages, seasonal economic dependency, and limited institutional capacity.

The paper argues that sustainable development in island contexts requires participatory governance, inclusive innovation ecosystems, and place-based strategies that reflect local realities. By situating island development within broader debates on peripheralization, productive capabilities, and participatory transformation, the study contributes to the literature on systemic development in island communities.

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Introduction

Island communities face a range of interrelated development challenges that extend beyond technical or environmental concerns. These include issues in circular economy implementation (Morales Lassalle *et al*., 2022)where electrical supply is not guaranteed. Because of their inherent geographic characteristics, islands are prominent cases of isolated areas that must import and burn fossil fuels, with environmental and economic consequences. In this context, Hybrid Renewable Energy Systems (HRES, demographic decline and depopulation (Santos *et al*., 2022), environmental stressors (Chen, 2025), mass tourism pressures (Skjølsvold *et al*., 2020), energy insecurity (Morales Lassalle *et al*., 2022) where electrical supply is not guaranteed. Because of their inherent geographic characteristics, islands are prominent cases of isolated areas that must import and burn fossil fuels, with environmental and economic consequences. In this context, Hybrid Renewable Energy Systems (HRES, and water infrastructure limitations (Chen, 2025). These challenges are manifested in concrete local conditions, such as youth outmigration (Harfst *et al*., 2025), housing shortages driven by seasonal markets and investment dynamics (Gentili & Hoekstra, 2019), economic dependency on seasonal tourism (Willett *et al*., 2025), and infrastructural constraints that limit access and service provision (Glass *et al*., 2019).

While these issues are often framed through technical or environmental lenses, they are fundamentally systemic in nature. Addressing them requires integrated, participatory approaches that engage local stakeholders in co-creating solutions (Basile & Caputo, 2017; Blomkamp, 2022; De Smedt & Borch, 2022; Hughes *et al*., 2017). Community vitality plays a central role in this process, serving as a foundation for resilience, adaptation, and innovation (Dale *et al*., 2010).

The objective of the Interreg North Sea program project *Facilitating Resilience Embracing Island Innovations* (FREIIA) is to create skills, resources, competences, capabilities, and structures that support the innovations and resilience needed for effective transformative policies in these communities (OPSI, 2023). The project focuses on developing a design thinking-based and practice-oriented framework to support local stakeholders. It maps the current state of the island innovation system and the challenges facing these communities, providing a basis for future explorations on how to enhance development capacity in response to these challenges. The Interreg FREIIA framework acknowledges that these systemic challenges (Jasanoff, 2015) involve numerous interdependent factors. Addressing them requires a deep understanding of their complexity, and active participation from all relevant stakeholders, emphasizing the need for interconnected and inclusive governance.

By employing such a framework, Interreg FREIIA aims to involve a diverse array of stakeholders in interdisciplinary and cross-sectoral collaboration, ensuring innovations are connected to the communities they serve, and are grounded in collective knowledge and expertise.

Research Question:

- *How do stakeholders in island communities perceive and address the challenges to resilience and innovation in the context of the green transition and societal changes?*

By situating island development within the broader discourse of participatory governance, productive capabilities, and systemic transformation, this paper contributes to the literature on local development in island communities. It highlights the importance of inclusive innovation ecosystems, collaborative governance structures, and location-relevant strategies for sustainable development.

1. Theory

Island community stakeholders describe challenges to resilience and innovation in the green transition as multifaceted. These challenges are not only technical or environmental in nature, but are, in fact, deeply embedded in the social, institutional, and economic fabric of island life (Van Dam & Van Der Windt, 2022).

In several studies, participants report that social obstacles, technical shortcomings, and institutional and economic barriers hinder progress due to the mismatch between local island needs and policies, geographic remoteness, and infrastructure (Leon *et al*., 2022; Ribalaygua *et al*., 2019; Tellarini & Gram-Hanssen, 2024)extreme temperatures, and drier conditions are the impacts with the most significant potential to amplify the economic damage on islands. However, their isolation and natural conditions bring about some leeway to respond to climate impacts on their terms. This paper aims to provide a local-level analysis and ranking of alternative adaptation pathways in an island context through the stakeholders' lens. This study reviews the latest advancements in adaptation science and proposes a catalogue of adaptation and risk management options that feed a participatory assessment and ranking by local stakeholders. The research was conducted on the island of Sicily (Italy. Islands face systematically more challenging adaptation processes, with fewer available options than mainland regions across environmental, social, and institutional dimensions (Petzold *et al*., 2023).

Literature argues how islands face distinctive challenges in green transitions because of their isolated infrastructure, economic and technical constraints, mismatches between local island needs and national policies, and community engagement (Barney *et al*., 2023; Bonvicini *et al*., 2024; Marczinkowski *et al*., 2022; Stephanides *et al*., 2019; Tellarini & Gram-Hanssen, 2024). In response to these challenges, stakeholders themselves have proposed a range of concrete strategies. These include the establishment of participatory engagement platforms, the strengthening of community-based organizations, and the development of collaborative policy mechanisms that better reflect local realities.

Much of the literature focuses specifically on energy transitions. It less often studies how island communities perceive and address the challenges to resilience and innovation, in the context of the green transition and societal changes, in a broader sense. Best practices at the island level remain less

documented and shared, making it challenging to benchmark or replicate successful models. This contributes to a gap between theoretical potential and practical implementation – particularly regarding the role of citizens, their social networks, and the dynamic interplay between location, local context, and external conditions.

In this paper, we examine transitions from a broader perspective, focusing on how they are embedded in everyday life, and how stakeholders perceive and address the challenges to resilience and innovation within the context of the green transition and wider societal change.

2. Method

2.1 Research Design

The research design is based on the Double Diamond (*The Double Diamond – Design Council*, n.d.), a design thinking framework (Brown & Katz, 2019; Buchanan, 1992) that contains two parts and four distinct phases (Fig. 1).

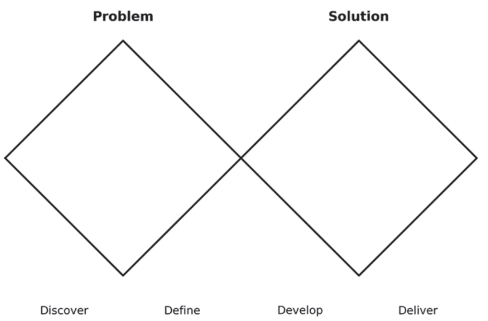

Figure 1. Research Design Based on the Double Diamond Model

The first part is about understanding and defining the problem. The second part is about developing and exploring different solutions. A distinctive feature is the combination of divergent and convergent thinking, which alternately opens up (The Discover and Develop phases) and narrows down (The Define and Deliver phases) the process.

The Discover phase in the study involved engaging local stakeholders to gather qualitative data on the current state of the island's innovation system, as well as on the barriers they face and the opportunities that are available to them. The insights gained from these interviews are crucial for the Define phase, identifying the specific needs and conditions of each island.

The second part saw an exploration of ideas that might solve the identified challenges, and the development of solutions through iterative prototyping. This workshop leveraged the data collected from the interviews to facilitate interdisciplinary and cross-sectoral collaboration among stakeholders. The goal is to co-create innovative solutions that are grounded in the collective knowledge and expertise of the community.

2.2 Data Collection

2.2.1 Interviews

In the Discover phase, stakeholders were interviewed on-site, among them local businesses, restaurants, offices, farms, and other local interested parties. These semi-structured interviews (Kvale & Brinkmann, 2015) represented the diverse voices within the island community, and established the basis for mapping the current situation of the island's innovation system. The stakeholders were partly suggested by the Interreg FREIIA partner on the island, and partly identified

through the snowball effect, which can be understood as broadening the sampling as the study progressed.

The interviews were structured around eight open-ended questions to allow for rich, reflective responses. Recordings were made with automated transcription, and translations were carried out using Nettskjema, the Norwegian universities' digital app for recording, storing, and transcribing research interviews. The recordings were then anonymized, in accordance with the signed consent form approved by the Norwegian Centre for Research Data (NSD).

2.3 Participants and respondents

The FREIIA project engaged a wide range of participants across six European islands over a three-year period. Table 1 provides an overview of the number of students, researchers, and local stakeholders involved in each intervention, categorized by year, island, and phase of the design thinking process. The data reflect a deliberate effort to ensure diversity in perspectives, with participants representing public institutions, private enterprises, civil society, and academia. The combination of problem exploration and solution development phases enabled a holistic understanding of local challenges and the co-creation of context-sensitive responses. (Table 1.)

Students (280) and researchers (27) include participants from the different partners in the project, including The Netherlands, Belgium, Denmark, Sweden, France and Norway. Local stakeholders (191) include public servants, politicians, local businesses, restaurants, offices, farms, and other local stakeholders on the respective islands (non-unique participant count).

2.4 Analysis

The transcriptions comprised a total of 148 interviews, spanning 2,301 pages, and amounting to 529,414 words. The transcriptions served as the basis for a Grounded Theory Method (GTM)-inspired analysis, through which the project team interpreted the interviews and identified innovation gaps, bar-

Table 1. Students, Researchers and Stakeholders

Year	2023			2024					2025		Total
Week	18	39	43	9	12	15	41	43	7	15	
Island	Hvaler	Schier-mon-nikoog	Hvaler	Born-holm	Schier-mon-nikoog	Born-holm	Koster	Koster	Groix	Oues-sant	
Phase	Prob-lem	Prob-lem	Solution	Prob-lem	Solution	Solution	Prob-lem	Solution	Both	Both	
Students	21	22	58	15	19	16	25	40	30	34	280
Researchers	5	3	4	2	1	2	2	4	2	2	27
Stakeholders	20	23	20	17	9	6	46	3	17	30	191
Total	46	48	82	34	29	24	73	47	49	66	498

riers, and challenges within the island community. These were reframed into concrete problem statements for later exploration in the Solution phase. The analysis involved the cyclic process of data collection, coding, categorization, theory development, and testing (Charmaz, 2000, 2006; Clarke, 2005).

In the first interventions, the transcriptions were manually examined line-by-line to code important segments describing innovation gaps, barriers, and challenges. These codes were continuously discussed and presented on a shared whiteboard. In the categorization step, we compared codes to examine the relationships between them, and organized them into categories that reflected higher-level challenges. This step helped us not only to understand how different codes were interconnected, but to identify important challenges present in the island communities, as per the transcriptions. These preliminary categories were tested for validation and refinement. AI was gradually introduced to support the exploration of interview material in the later interventions, partly out of curiosity, and partly to meet practical needs, enabling the project to include more stakeholders within the limited time available on the islands. We used manual sampling of the data to ensure accurate AI interpretations.

2.5 Ethical Considerations

The study was assessed by the Norwegian Centre for Research Data (NSD) for ethical compliance and data protection standards (Ref.nr. 789531).

3. Results

Table 2 summarizes the main challenges identified through stakeholder interviews, the solutions proposed during co-creation workshops, and the key insights that emerged from each island context. The challenges reflect systemic issues, such as demographic shifts, infrastructural limitations, and governance gaps. The proposed solutions – ranging from mobile innovation hubs to intergenerational service exchanges – demonstrate the creativity and agency of local actors when provided with participatory platforms. The insights column distills the core themes that stakeholders emphasized as critical for sustainable development.

A summary of the key challenges, proposed solutions, and key insights, based on the interventions with stakeholders on the six different islands, is presented in Table 2.

To identify broader patterns, Table 3 synthesizes recurring themes across the six islands. These include housing affordability, youth outmigration, seasonal economic dependency, and limited cross-sector collaboration. While each island faces unique circumstances, the table illustrates how many of the challenges are shared across contexts, suggesting the presence of structural constraints common to peripheral regions. This comparative perspective strengthens the argument for systemic, rather than isolated, interventions.

A summary of recurring themes and similarities in challenges and solutions on the different islands is presented in Table 3.

Table 2. Summary of Key Challenges, Proposed Solutions and Key Insights

Island	Key Challenges (from the interviews)	Proposed Solutions (from The Design Thinking WS)	Key Insights
Hvaler, Norway	- Limited cross-sector collaboration - Aging population and youth outmigration - Seasonal tourism dependency - Lack of innovation platforms	- Mobile innovation hub - Decentralized university facilities - Project house for collaboration - Improved transport - Community collaboration platforms - Mobile sauna initiative	- Need for year-round tourism - Importance of collaboration - Youth engagement is essential
Schiermonnikoog, Netherlands	- Low understanding of the circular economy - Youth outmigration - Limited collaboration - Space/resource constraints	- Key stakeholder collaboration - Social media & influencers - Collaboration arena - Blue minimal surfing camp - Educating children on waste	- Desire to retain youth - Need to localize sustainability - Strong local identity
Bornholm, Denmark	- Tourism dependency - Lack of off-season services - Youth outmigration - Weak collaboration	- Youth engagement & education - Collaboration & innovation - Marketing Bornholm as a living destination	- Attracting young families - Infrastructure and collaboration needed
Koster, Sweden	- High housing prices - Closed school, limited services - Summer overcrowding - Economic barriers	- Reopen local school - Public-private trust program - Marketing Koster to Scandinavian businesses - Intergenerational service exchange	- Desire for year-round residents - Need for trust and collaboration - Balance tourism and residency
Groix, France	- Lack of affordable housing - Limited municipal resources - High seasonal rent - Infrastructure gaps	- Extend tourist season - More recycling stations - Eco transport & bike infrastructure - Promote local products - Regular stakeholder meetings	- Sustainable tourism focus - Need for visibility and collaboration - Environment-economy link
Ouessant, France	- Housing shortage - Energy & water infrastructure - Local food production - Transport & accessibility - Lack of digital innovation	- Seasonal housing - Energy education programs - Island Council for local dialogue & governance	- Collaboration between locals and seasonal residents - Local governance - Sustainability integration

4. Discussion

In the introduction, we asked *how stakeholders in island communities perceive and address the challenges to resilience and innovation in the context of the green transition and societal changes*. The findings reveal both local entanglements and systemic interdependencies (Table 3). Below, we examine these interconnected themes, highlighting their implications for local governance and broader regional development.

4.1 Housing

Housing prices were a recurring theme across the islands. We recognize it from conversations with local stakeholders in somewhat different versions. Structural measures have been taken to assist with equity, and to create housing solutions specially tailored to young people. Nevertheless, it seems that the measures do not satisfy or encourage the target group as well as expected.

Table 3. Themes and Similarities Across the Islands

Theme	Hvaler, Norway	Schiermonnikoog, Netherlands	Bornholm, Denmark	Koster, Sweden	Groix, France	Ouessant, France
Housing Issues	Few areas for youth housing	Seasonal housing; young workers live at work	Seasonal housing due to tourism	School closed; not supportive of families	Housing too expensive; dominated by tourist rentals	Hard to find affordable lodging during tourist season
Aging Population & Youth Retention	Dominated by retirees; need families	Few young permanent residents	Youth leave due to lack of opportunities	Hard for young families to settle	Need more young people; avg. age ~45	—
Tourism Dependency & Seasonality	Population swells from 4,700 to 30,000	Summer boom, winter shutdown	Economy depends on tourism	More tourists than locals in summer	Rentals reserved for tourists	Tourism is main economic activity
Infrastructure & Services	Depends on Fredrikstad for many services	—	Decline in industry; limited diversity	Closed school, minimal services	Lack of social services and infrastructure	Limited accommodation and services during the tourist season
Cross-sector Collaboration	Improving public-private collaboration	Poor cross-sector communication	—	Local initiatives, no structured collaboration	Lack of shared initiatives	—
Environmental Regulation Pressure	—	—	Environmental rules hurt agriculture/ fisheries	Fishing threatened by regulation	Declining economy tied to fishing	Fishing declined; tourism dominates
Geographic Isolation	Relies on mainland; limited development space	Isolated despite accessibility	"Peripheral Denmark"	"We are far away"; limited inter-island ties	"Cut off from the world"; lack of support services	Long ferry ride; perceived as distant
Innovation & Youth Engagement	High housing prices, few job prospects	Wealthy non-residents reduce engagement	Promoting year-round tourism & entrepreneurship	Lack of services for young families	Need to reclaim economy for youth	Bureaucracy blocks implementation of ideas
Community Identity	Deep generational ties	Strong collective memory	"Denmark's Hawaii"; strong pride	Long family traditions	Pride in staying; want to raise families	Distinct local character noted by tourists
Seasonal Imbalance	Summer surge in population	Summer full, winter quiet	Seasonal income replaces agriculture/ fishing	Quiet off-season; limited year-round economy	Seasonal jobs dominate; unstable housing	Hotels depend on early summer bookings
Communication & Participation	Better dialogue emerging	Insufficient municipal-citizen platforms	Calls for collective strategies	Active citizens, limited formal influence	Lack of community spaces and organization	—

The analysis points to underlying structures and practices that shape housing availability. It suggests conflicting interests and positions (e.g., between young and old, between residence and investment object), market dynamics (such as how the cottage market affects the housing market), and political and economic strategies (like residency obligation and loan schemes). Structures and practices keep young adults out of the housing market, constraints that directly influence demographic patterns, particularly youth retention and return migration, which we discuss next.

4.2 Youth outmigration

The interviews highlight the complexity of encouraging young adults to return to the islands after completing higher education. Together with housing prices, this creates a significant barrier to growth and change. Returning is not a matter of a single policy measure, but requires systemic shifts that affect multiple aspects of island life. An illustration of this is that attractive job opportunities are necessary to entice those with higher education to choose the islands, yet the very absence of young adults with advanced degrees makes it difficult for businesses meeting these needs to establish themselves on the islands in the first place.

Stakeholders describe a lack of existing arenas for young adults, who appear to remain "on the sidelines of the established social network." This points to a need for new venues and meeting places, and highlights the importance of networks and communities that align with the interests and skills of young adults.

There is recognition that the concept of the traditional workplace "is dying out," and that new initiatives, such as start-ups, may be necessary to stimulate job creation and attract young adults. This puts at the center of attention the symbiotic relationship between access to the job market and the community's ability to renew and revitalize itself through innovation and entrepreneurship. The local municipalities appear to be perceived as key players in realizing this work, reflected in the quote: "When it comes to this initiative, it must [come from] public funds." This acknowledges a commitment by the municipality to act as a catalyst for change and development through subsidies and support schemes that can create the necessary conditions to attract young adults.

The results describe the complexity of the local community's demographic challenges and opportunities, illuminating not only the immediate issue of age concentration, but also the underlying social and economic factors, such as the need for a more inclusive and sustainable community, and support for new industries relevant to young adults.

Further, the results suggest that the key to attracting young adults and developing a heterogeneous community of innovative thinking lies in anchoring diversified business activity and interdisciplinarity. The connection between new business activity and the ability to attract a younger demographic segment – which can also contribute to transforming the islands into a year-round community – is emphasized: "The hope is that business activity will attract the young."

The reluctance of young people to return to the islands after studying in urban areas

highlights the need for attractive job opportunities and supportive community structures. These demographic challenges shape the community's capacity for systemic change.

4.3 Change

Change is challenging, and is especially demanding when it involves actors with differing perspectives and interests, much like the processes of creating growth and development within a local community. Often, unrealistic expectations are placed on other actors, especially on the public sector's ability to support various initiatives.

The interviews show tensions between expectations and opportunities within the local community. "They say they want it. But some concrete action? I can't actually say [anything] has been done on the part of the municipality." This highlights a gap between intentions and concrete initiatives. At the same time, the perception that "it's very difficult to build new here" indicates a restrictive local policy that can hinder innovation and development.

The challenges of realizing change are linked to situations where there is a need for closer collaboration between the numerous stakeholders, and where the local population may seem to be skeptical of new, external influences: "Those who sit on the resources ... are very skeptical of people coming from outside." This may point to the necessity of a cultural change or shift to better accommodate new thinking and external contributions to the community's growth and development.

One of the solutions proposed by a stakeholder suggests a "closer dialogue with politicians" to simplify and accelerate decision-making processes, indicating an acknowledgment of the need for inclusive forums that promote participation and collaboration. These insights point to broader lessons for governance models beyond island contexts, a fact which we address below.

Conclusions

This study explored systemic challenges and opportunities describing resilience and innovation in island communities within the context of the green transition. Through the FREIIA project, a participatory, design-driven approach was employed to engage a wide range of stakeholders across six European islands. This geographic diversity enhanced the findings and allowed for the identification of important local conditions and features, as well as shared challenges.

The findings underscore that these challenges are interlinked, suggesting systemic interventions rather than isolated measures. Housing challenges and demographic trends reinforce each other, while governance and attitudes influence the capacity for change. Stakeholders emphasized the importance of participatory governance, inclusive innovation ecosystems, and location-based strategies for sustainable development.

While grounded in island contexts, these findings could have broader relevance. Similar structural challenges are seen in other regions. This suggests that approaches like design-thinking and co-creation processes can inform policy and practice beyond islands. Future research should examine how these strategies can be adapted to different territorial settings.

By situating these insights within systemic development theory and participatory innovation, this study contributes to regional development literature and offers actionable guidance for policymakers seeking to foster resilience and inclusive growth in vulnerable communities.

Further work

In the context of significant societal challenges, it is critical to ensure that innovations are deeply connected to the communities they serve. Participation is important in this process. By highlighting the importance of participation, this study sets the stage for policies and innovation processes that connect to the collective intelligence, skills, and expertise of all stakeholders on the islands. This collective approach to innovation results in solutions that are socially and economically viable, and which align with community needs, thereby empowering both individuals and the community as a whole.

Future research should explore additional strategies and structures for fostering resilience and innovation in island communities, particularly in the context of evolving societal and environmental challenges.

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Declarations

The Norwegian Agency for Shared Services in Education and Research assessed the study (Ref.nr. 789531) for ethical compliance and data protection standards.

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