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Research Article

EMBEDDING SUSTAINABILITY THROUGH DESIGN THINKING: EVIDENCE FROM THE ORSÙ INNOVATION LAB CASE

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Abstract: The growing recognition that sustainability must be embedded as an intrinsic individual and organizational capacity, rather than pursued through external compliance has generated significant interest in frameworks capable of operationalizing this shift. This paper examines how Design Thinking can serve as a practical mechanism for translating SustainAbility, defined as the intrinsic dynamic capacity to internalize and act upon sustainable principles (Carrassi et al., 2025a), into an operational, participatory process. Drawing on a qualitative single case study of the Orsù Innovation Lab (Università degli Studi di Bari Aldo Moro, 2025 edition), the study traces how a structured Design Thinking process applied to urban green space regeneration activated latent needs, fostered co-creation, generated behavioural learning through prototyping and testing, and produced observable indicators of SustainAbility emergence among participants and stakeholders. The findings demonstrate that Design Thinking does not merely support sustainability goals but functions as a generative process through which SustainAbility becomes experientially constructed. Implications are drawn for university education, urban governance, and the design of innovation labs as sites of sustainability transformation.

Keywords: SustainAbility, Design Thinking, urban regeneration, university innovation lab, participatory design

1. INTRODUCTION

The transition from sustainability as an external obligation toward sustainability as an intrinsic organizational and individual capacity reflects a broader evolution in contemporary sustainability research, which increasingly emphasizes behavioural change, adaptive learning,

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and the development of internal capabilities for transformation (Christensen et al., 2021; Ali et al., 2023). Traditional compliance-driven approaches—such as non-financial reporting frameworks and corporate social responsibility mandates—have often proved insufficient to generate the deep behavioural and systemic shifts required for genuine sustainability transitions. This limitation has encouraged scholars to explore frameworks capable of embedding sustainability within the cognitive, behavioural, reflective, and organizational dimensions of action.

Within this emerging stream, the SustainAbility framework has been proposed as a dynamic intrinsic capacity composed of cognitive abilities (systems literacy, critical thinking, long-term visioning), behavioural abilities (sustainable habit formation, collective action), and reflective abilities (ethical judgment, reflexive learning, and recalibration) (Carrassi et al., 2025a). Building on this perspective, recent work has further suggested that Design Thinking may represent a particularly suitable methodology for operationalizing SustainAbility through iterative learning, systems thinking, behavioural alignment, and innovation-oriented organizational cultures (Carrassi et al., 2025b).

Yet a critical gap remains: both contributions are primarily theoretical. Empirical evidence of how Design Thinking concretely activates SustainAbility in real-world settings remains scarce. This paper addresses that gap by presenting a qualitative case study of the Orsù Innovation Lab, a university-based innovation laboratory at the Università di Bari Aldo Moro (Italy), where a structured Design Thinking process was applied to the challenge of urban green space regeneration.

The central research question guiding this study is: How can Design Thinking translate SustainAbility from a conceptual framework into an operational and participatory process of urban green regeneration?

The paper proceeds as follows. Section 2 reviews the theoretical foundations. Section 3 describes the methodology. Section 4 provides an overview of the case. Section 5 presents the findings organized around four thematic blocks. Section 6 discusses the implications and Section 7 concludes.

2. THEORETICAL BACKGROUND

2.1. SustainAbility: An Intrinsic Capacity for Systemic Change

The concept of SustainAbility, as developed by Carrassi et al. (2025a), represents a paradigm shift from sustainability as external compliance toward sustainability as a deeply internalized and dynamically exercised capacity. Drawing on behavioral change theory (Prochaska & DiClemente, 1983; Kollmuss & Agyeman, 2002), systems thinking (Meadows, 2008; Senge et al., 2008), and organizational resilience frameworks (Folke et al., 2016), the framework identifies three interconnected dimensions. Cognitive abilities encompass systems literacy, critical reflection, and the capacity to reason across temporal and spatial scales. Behavioral abilities involve the active adoption of sustainable practices, the overcoming of cognitive biases and inertia, and the cultivation of collective action. Reflective abilities concern ethical discernment, reflexive learning, and the capacity to recalibrate choices and interpretations in light of consequences, tensions, and new understanding.

Critically, SustainAbility is understood as a dynamic capability, one that evolves through experience, learning, and iterative engagement with real-world challenges (Teece, 2007). In this sense, its developmental logic is closely aligned with what Carrassi et al. (2025a) describe as the Spin Effect: a cyclical movement through understanding, action, and reflection that progressively deepens the individual and collective internalization of sustainability. This

positions experiential, process-based methodologies as central to its development, rather than as supplementary delivery mechanisms.

2.2. Design Thinking as a Methodology for SustainAbility

Design Thinking has emerged as a transformative methodology particularly suited to the complexity and interconnectedness of sustainability challenges (Brown, 2009; Dorst, 2011). Its core phases Empathize, Define, Ideate, Prototype, and Test, provide a structured yet flexible process that prioritizes human-centeredness, iterative learning, and collaborative problem-solving (Liedtka & Ogilvie, 2011; Johansson-Sköldberg et al., 2013). Unlike linear problem-solving approaches, Design Thinking embraces ambiguity, encouraging experimentation and co-creation as generative rather than merely instrumental activities.

Carrassi et al. (2025b) proposed a four-pillar framework explicitly connecting Design Thinking to SustainAbility: (1) aligning behavior with systemic sustainability goals through empathy and stakeholder engagement; (2) embedding iteration as an adaptive mechanism through prototyping and testing cycles that enable continuous improvement; (3) operationalizing systems thinking through causal mapping and leverage point identification; and (4) fostering a culture of innovation and resilience through interdisciplinary collaboration and experiential learning. Collectively, these pillars position Design Thinking not merely as a project management tool but as a generative process through which SustainAbility can be constructed and sustained.

2.3. University Innovation Labs as Sites of Sustainability Transformation

Universities occupy a privileged position in sustainability transformation, combining educational mandates with research capabilities and community embeddedness (Sterling, 2011; Filho, 2019). University innovation labs, structured environments where students, faculty, institutions, and external partners collaborate on real-world challenges, have been identified as particularly fertile sites for this transformation (Manzini, 2015). By exposing participants to genuine complexity, demanding iterative action, and requiring multi-stakeholder engagement, these labs create conditions conducive to the development of SustainAbility as an emergent competence. Their potential as empirical sites for studying the operationalization of sustainability frameworks remains, however, largely unexplored.

Addressing this gap requires close examination of innovation labs as lived experimental settings in which sustainability is not merely discussed conceptually, but enacted through collaborative problem framing, iterative prototyping, and reflective learning processes. In this perspective, university innovation labs offer a particularly valuable context for investigating how SustainAbility can be cultivated, observed, and interpreted in practice.

3. METHODOLOGY

To explore this process empirically, this study adopts a qualitative single-case study design (Yin, 2018), appropriate when the research objective is to understand how and why a phenomenon unfolds within a bounded real-world context (Eisenhardt, 1989). The selected case is the Orsù Innovation Lab (2025 edition) at the Università di Bari Aldo Moro, Italy, a university-based innovation lab explicitly structured around collaborative challenge-based learning, stakeholder engagement, and iterative design processes. As such, it offers a revelatory setting for examining the emergence and operationalization of SustainAbility in practice.

Data sources include: (1) structured process documentation produced by student teams across all phases of the Design Thinking cycle, including interview transcripts, persona narratives, HMW question formulations, benchmarking reports, brainstorming outputs, and prototype documentation; (2) reflective accounts produced by participants and tutors; and (3) observational records from field activities, including the exploratory walking tour and external contamination sessions. The documentation was compiled into a comprehensive report by the student cohort at the conclusion of the process.

Analysis followed a theory-informed thematic approach (Braun & Clarke, 2006), using the four-pillar SustainAbility/Design Thinking framework (Carrassi et al., 2025b) as an analytical lens. The four pillars guided the identification of thematic blocks in the findings section, while remaining open to emergent categories surfaced by the data.

Methodological limitations include the single-site, single-cohort design, which constrains statistical generalizability. The findings are offered as analytical generalizations (Yin, 2018), theoretical propositions that can be tested and refined in broader contexts, rather than as claims about population-level regularities.

4. CASE DESCRIPTION: THE ORSÙ INNOVATION LAB

The Orsù Innovation Lab is a transversal competencies laboratory established within the Department of Economics and Finance at the Università di Bari Aldo Moro, open to students from all university departments. Operating on an Open Innovation model, it connects students with institutions and companies to address real-world challenges with an explicit orientation toward sustainability and innovation. The process is structured around Design Thinking methodology and culminates in the co-development of innovation prototypes to be presented to the stakeholders involved.

Since its launch in 2018, ORSÙ Innovation Lab has had a significant impact on the employment prospects of the students involved. The value of the educational model was recognised internationally in 2025 with the ICSB Global Award in the Undergraduate Entrepreneurship Education Excellence category, presented by the International Council for Small Business.

In 2025, Orsù Innovation Lab established “Green Connect,” an internal laboratory dedicated to environmental sustainability. Embedded within an ecosystem already oriented toward multidisciplinarity, Green Connect represents an organizational evolution in which the integration of diverse competencies becomes a structural requirement of the design and development processes. The challenge assigned to the cohort was the regeneration of underutilized and fragmented green spaces surrounding the Faculty of Economics and the Dell’Andro student residence in the Poggiofranco district of Bari, encompassing approximately seven hectares of centuries old olive groves, a landscape of significant ecological, historical, and cultural relevance in the Apulian context, yet perceived as unsafe, poorly maintained, and disconnected from the everyday life of its users.

The challenge was framed not as an aesthetic intervention but as a participatory design problem: how can we activate these spaces in an inclusive, low-impact, and functionally meaningful way, generating real value for the university community and surrounding citizens? This framing directed the Design Thinking process toward systemic rather than superficial solutions, nd explicitly positioned students as agents of a community-centered sustainability process rather than as external designers.

Building on the first laboratory and the feedback received at regional level, and with the allocation of funds to enable the development of projects, a second laboratory has now been launched in 2026.

The following section outlines the process and the resulting projects stemming from the design thinking process.

5. FINDINGS

5.1. Empathy and Needfinding as Activation of Latent Needs

The Empathize phase was conducted through more than 120 semi-structured interviews distributed across three stakeholder categories: university students (including dormitory residents), university staff (academic and administrative personnel), and citizens of the surrounding Poggiofranco neighborhood. Interviews were distributed across all four groups, with effort made to ensure diversity in terms of age, gender, and professional background. Interviewers worked in pairs, with one conducting the conversation and the other observing non-verbal cues, a deliberate methodological choice that foregrounded the relational and embodied dimensions of empathic inquiry.

Rather than seeking solutions or stated preferences, the process was designed to surface latent needs, the underlying motivations, frustrations, and aspirations that participants themselves had not necessarily articulated prior to the encounter. Questions were open-ended and narrative-driven, probing specific memories and behaviors rather than abstract opinions. This approach required a sustained shift in orientation for student interviewers: from information gathering toward empathic listening.

The synthesis of interview data revealed several recurring need clusters: the desire for spaces that convey a sense of safety, maintenance, and civic care; the need for informal, pressure-free outdoor environments where students could pause, study, or simply breathe; the aspiration for intergenerational connection between the university and the surrounding neighborhood; and the demand for event spaces and cultural occasions accessible beyond the academic community.

Three emotional states characterized the majority of encounters: hope, expressed by those who welcomed the initiative and felt validated in their aspiration for better spaces; loneliness, particularly acute among dormitory-dwelling students, who experienced the campus environment as socially isolating; and frustration, especially visible among citizens, who expressed distrust toward public institutions and cynicism about the prospects of genuine intervention. These emotional registers proved analytically significant: they pointed to dimensions of the problem that functional needs analysis would have missed entirely.

A particularly significant methodological moment was the exploratory walking tour of the green spaces, conducted collectively by all participants. This embodied encounter with the site, guided by distributed materials describing each area's history, constraints, and potential, allowed students to inhabit the challenge spatially and emotionally. The encounter with two residents during the walk, who spontaneously joined the group and articulated their longing for a quiet, well-tended place to rest, functioned as a powerful, unscripted confirmation of the latent need the project was addressing.

From the interview synthesis, three representative personas were constructed: Luca, a middle-aged professional who passes through the neighbourhood daily without engaging with it; Nicola, a dormitory-resident student seeking outdoor spaces to decompress between study sessions; and Giulia, a PhD researcher experiencing social fragmentation within the academic environment. These personas functioned not as marketing artifacts but as boundary objects (Star & Griesemer, 1989): shared representations anchoring subsequent design work in concrete human realities.

5.2. Co-Creation and Reframing of Sustainability Problems

The Define and Ideate phases translated needfinding insights into generative design questions through the structured use of How Might We (HMW) questions, a facilitation technique that transforms problem statements into open-ended design opportunities (Liedtka & Ogilvie, 2011). Each group developed six HMW questions, one pair per persona, addressing distinct dimensions of the challenge. This reformulation proved critical: it shifted participants' orientation from proposing predetermined solutions to exploring possibilities, reducing premature convergence on obvious answers.

Two external contamination sessions extended the groups' reference frame. The first involved a visit to Ortodomingo, a social orchard and community garden in Bari, which demonstrated how a modest, well-managed green space could generate social cohesion, civic responsibility, and sustainable habits through simple and replicable mechanisms. The second session featured an architect specializing in urban regeneration, who introduced participants to cases of participatory lightweight interventions, from outdoor coworking structures to modular food forests, consistently emphasizing that the long-term sustainability of a space depends as much on its governance and maintenance model as on its physical design.

Benchmarking exercises conducted in parallel reinforced these insights: international cases including TreeXOffice (London), Picasso Food Forest (Parma), and Prebys Amphitheater (Indiana University, USA) illuminated transferable principles, usable and movable street furniture, community ownership models, programming as space activation, and low-impact reversible design. These cases shifted students' evaluation criteria from aesthetic ambition to systemic viability.

The brainstorming phase generated over 600 ideas across the four groups. A two-stage selection process, narrowing to five ideas per group, then to three, followed by a deliberate reshuffling of team composition, resulted in six final concepts, each developed by a newly constituted team drawing on insights from across the cohort. This reorganization proved particularly significant: by requiring students to advocate for ideas they had not originally generated, it cultivated intellectual generosity, reduced attachment to solutions as expressions of group identity, and modeled the kind of collective agency that SustainAbility requires.

5.3. Prototyping and Testing as Behavioral Learning

The Prototype and Test phases produced six physical prototypes, each representing a distinct vision for the regeneration of the campus green spaces. The “FantaBosco” concept proposed a forest nursery and outdoor educational space for early childhood, centered on nature-based pedagogy, designed to serve university families, academic staff, and the surrounding community. The “Amphitheater ParAdisu” reimagined the campus green as a lightweight outdoor cinema and cultural space, with students as curators of content and moderators of post-screening dialogues. The “Garden of Knowledge & Social Kitchen” combined a didactic intergenerational garden with a modular container kitchen, creating an ecosystem linking food production, cooking, social learning, and community dining. The “Cycle Path & Green Fitness Area” proposed a multisport circuit integrating jogging, fitness stations, and accessible outdoor exercise areas designed for both academic and community users. The “Sail among the olive trees fountain” introduced an eco-sustainable sculptural fountain using local materials and solar-powered closed-circuit water recycling, functioning simultaneously as a visual landmark, acoustic barrier, and gathering point. The “Ulivo Lounge” transformed the existing olive grove into a low-impact lounge area with ergonomic seating, hammocks, a mobile Wi-Fi hub, and a kiosk inspired by the trullo, a vernacular Apulian

architectural form, creating a deliberate bridge between local cultural identity and contemporary academic life.

The prototyping process was iterative and deliberately rough: pre-prototypes were circulated in class for peer and tutor feedback before final prototypes were developed. Testing revealed consistent patterns across all six concepts. The governance and maintenance model was universally identified as the critical factor for long-term viability, confirming the insight from the contamination sessions. Users repeatedly expressed that what made a space trustworthy and worth inhabiting was not its complexity but its visible signs of care and activation. Physical safety and basic service provision were identified as prerequisite conditions, not optional enhancements.

Beyond technical design competencies, this phase generated a distinctive form of behavioral learning. Students confronted the tension between ambition and feasibility, between aesthetic vision and inclusive accessibility, and between individual creative ownership and collective responsibility for a shared outcome. The physical act of building, assembling, testing, revising, externalized ideas in ways that verbal discussion could not, enabling a more honest encounter with uncertainty. Accepting that a prototype was improvable, rather than defending it, became a practiced rather than merely stated value.

5.4. Emergence of SustainAbility in Participants and Stakeholders

Across the four phases of the process, observable indicators of SustainAbility emergence were documented at multiple levels. At the individual level, participants underwent a progressive shift from passive recipients of a methodology to active agents exercising situated judgment under genuine uncertainty. The initial tendency to seek correct answers gave way to a more confident engagement with ambiguity, a form of cognitive ability consistent with the SustainAbility framework (Carrassi et al., 2025a). Students who had entered the process expecting to be taught a technique left it with a practiced capacity to navigate complexity collaboratively.

At the behavioral and reflective levels, the process generated growing capacity for empathic listening, collaborative reframing, deliberate risk-taking, and reflexive reassessment of assumptions. The team reshuffling compelled participants to disengage from positional defense and engage constructively with peers' ideas, modeling the kind of collective action orientation that the behavioral dimension of SustainAbility requires. The exploratory walking tour produced a qualitative shift in participants' relationship to the physical space: several students described experiencing the site as genuinely "theirs" for the first time, expressing a sense of agency, responsibility, and reflective attachment toward a public space they had previously traversed without attending to.

At the stakeholder level, the process activated engagement extending beyond the student cohort. Once you have embraced the core principles of SustainAbility on an individual level, this automatically creates a spin effect, which creates new connections and strengthens existing ones. Citizens encountered during field interviews expressed hope and renewed curiosity about the initiative; external contributors to the contamination sessions became invested interlocutors rather than mere presenters; the residents encountered during the walking tour spontaneously participated in the conversation, articulating needs and validating the project's direction. These interactions point toward an emergent organizational and community dimension of SustainAbility: the capacity of a well-designed lab process to construct, however temporarily, a community of practice organized around a shared sustainability challenge (Wenger, 1998).

6. DISCUSSION

The findings provide empirical support for the theoretical propositions advanced by Carrassi et al. (2025b). Each of the four pillars of the SustainAbility-Design Thinking framework was operationalized through specific and identifiable moments in the Orsù process.

The first pillar, aligning behavior with systemic sustainability goals, was most visible in the Empathize phase. Empathic interviewing, persona development, and the exploratory walking tour moved participants from a superficial understanding of the challenge to a systemic appreciation of the interconnected needs, frustrations, and aspirations of multiple stakeholder groups. This shift in perspective, from "what should be built" to "for whom, why, and under what conditions", constitutes a form of behavioral alignment in the sense intended by the framework.

The second pillar, embedding iteration as an adaptive mechanism, was enacted through the pre-prototyping, testing, and revision cycle. Rather than treating design as a one-shot creative act, the process embedded feedback loops that allowed ideas to evolve in response to real-world signals. Students learned to treat partial failure as information, adjusting their concepts iteratively rather than defending initial positions. This disposition, adaptive rather than defensive, corresponds directly not only to the behavioral awakening dimension of SustainAbility but also to its reflective capacity for recalibration (Carrassi et al., 2025a).

The third pillar, operationalizing systems thinking, manifested most clearly in the benchmarking and contamination phases. Exposure to real-world examples of urban regeneration enabled participants to identify transferable principles and systemic patterns: the centrality of governance, the role of community ownership, the difference between an aesthetic intervention and a spatial activation. These insights reoriented the ideation process from object-centered design toward ecosystem thinking, addressing root causes rather than surface symptoms.

The fourth pillar, fostering a culture of innovation and resilience, was most evident in the team reshuffling and the collaborative dynamics of the final prototyping phase. By deliberately disrupting group attachments and redistributing expertise, the process created conditions for interdisciplinary synergy and adaptive learning. Participants found it easier to evaluate ideas critically when they were no longer their originators, modeling the kind of intellectual openness and organizational resilience the framework identifies as essential to sustained SustainAbility.

Beyond confirming the four-pillar framework, the case surfaces an important additional proposition: SustainAbility does not precede the Design Thinking process as a prerequisite but emerges through it. The lab did not select participants with pre-existing sustainability competencies; the process itself generated them. More specifically, the sequence of empathic inquiry, reframing, prototyping, and reflection appears to activate a recursive learning dynamic consistent with the Spin Effect described by Carrassi et al. (2025a). This has direct implications for how university innovation labs are designed and evaluated. If SustainAbility is an emergent property of well-structured participatory processes, then the quality of process design, not only the quality of outputs, becomes a key indicator of educational and societal value. Output evaluation alone (what was prototyped) misses what matters most (who the participants became through prototyping it).

The case also highlights the generative role of the challenge itself. The urban green regeneration context proved particularly apt for activating SustainAbility because it combined ecological, social, and institutional dimensions in a single, locally rooted problem. Participants could observe the consequences of their design choices in a tangible space they inhabited daily, making the feedback between action and impact unusually direct. This suggests that the choice

of challenge is not merely logistical but theoretically significant: challenges that are simultaneously local and systemic, visible and unresolved, appear most conducive to SustainAbility emergence.

7. CONCLUSION AND IMPLICATIONS

This study set out to examine how Design Thinking can translate SustainAbility from a conceptual framework into an operational participatory process. The Orsù Innovation Lab case demonstrates that this translation is not only possible but generative: the Design Thinking process did not merely apply SustainAbility principles but actively constructed them through structured engagement with genuine complexity.

The findings carry implications across three domains. For university education, the case supports a reorientation from knowledge transmission to process engagement. Sustainability education that exposes students to real challenges, equips them with participatory methodologies, and holds them accountable to real-world outcomes produces forms of learning that conventional classroom settings cannot replicate. The Orsù model, combining field research, multi-stakeholder contact, iterative prototyping, and interdisciplinary collaboration, offers a replicable template for institutions seeking to embed SustainAbility within their educational mission.

For urban governance, the case demonstrates the underutilized potential of university–community partnerships in activating public spaces. The process generated six credible, community-grounded proposals for the regeneration of underused campus green areas, alongside documented understanding of local needs that could directly inform public planning. Universities as Open Innovation actors, bridging student creativity and civic challenges, represent a largely untapped resource in urban sustainability governance.

For the design of innovation labs, the findings suggest that structural features of the process, particularly cross-team reshuffling, external contamination, embodied fieldwork, and governance-focused feedback, are as important as the challenge itself. Labs that invest in process quality, not only in output quality, are more likely to produce durable SustainAbility in their participants.

This study carries several limitations. The single-case design restricts generalizability to comparable institutional and territorial contexts. The absence of longitudinal follow-up means that the durability of the SustainAbility indicators observed cannot be assessed. Future research should explore replication across different university contexts, cultural settings, and challenge domains, and should develop instruments for measuring the longer-term behavioral and institutional effects of Design Thinking–based sustainability education.

SustainAbility, this case suggests, is not a quality that institutions can decree, or individuals can acquire through instruction alone. It is constructed, iteratively, collaboratively, and imperfectly, in the encounter between a process, a challenge, and the human beings willing to engage honestly with both.

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