Received 24 March 2025
Revised 22 August 2025
2 January 2026
Accepted 29 January 2026

Sustainable transition in the living industry: an explorative study of the early phases of a publicly funded innovation network

Chiara Ancillai and Andrea Sabatini
Department of Management, Polytechnic University of Marche, Ancona, Italy
Antonella La Rocca
Department of Economics and Business Management Sciences, Catholic University of the Sacred Heart, Milan, Italy, and
Andrea Perna
Department of Management, Polytechnic University of Marche, Ancona, Italy and Department of Civil and Industrial Engineering; Industrial Engineering and Management, Uppsala University, Uppsala, Sweden

Abstract

Purpose – This study analysed the foundational conditions that underpin the establishment of a publicly funded innovation network (PFIN) aimed at fostering sustainability transitions in the living industry.
Design/methodology/approach – Methodologically we have conducted an exploratory and qualitative study by conducting 2 focus groups, including 11 participants.
Findings – Analysis of regional stakeholders' perceived needs identified two key categories: enhancing firms' skills and capabilities and strengthening relationships within a broader innovation ecosystem, including interactions among firms, between firms and users and between firms and policymakers.
Originality/value – Adopting a bottom-up perspective, this study contributes to the literature on sustainability transitions and PFINs by elucidating the early-stage needs of actors likely to engage with PFINs. Addressing these needs from the outset can help shape the activities of PFINs, ensuring a more targeted and effective approach to fostering sustainable transitions.

Keywords Innovation, Sustainability, PFIN, Network, Policy, NRRP
Paper type Research article

1. Introduction

In recent years, sustainability has emerged as a central grand challenge across various sectors (Ciasullo *et al*., 2019; Farla *et al*., 2012). There is a broad consensus that critical environmental issues, such as climate change, biodiversity loss and resource depletion, are largely driven by unsustainable consumption and production patterns embedded in socio-technical systems,

Funding: This research has received funding from the project Vitality – Project Code ECS00000041, CUP I33C22001330007 – funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.5 – "Creation and strengthening of innovation ecosystems," construction of "territorial leaders in R&D" – Innovation Ecosystems – Project "Innovation, digitalization and sustainability for the diffused economy in Central Italy – VITALITY" Call for tender No. 3277 of 30/12/2021, and Concession Decree No. 0001057.23-06-2022 of Italian Ministry of University funded by the European Union – NextGenerationEU.

European Journal of Innovation Management
Vol. 29 No. 11, 2026
pp. 76-103
Emerald Publishing Limited
e-ISSN: 1758-7115
p-ISSN: 1460-1060
DOI 10.1108/EJIM-03-2025-0357

including those relating to electricity, buildings, transport and agriculture (Köhler *et al*., 2019; van Dokkum *et al*., 2023).

In response, policymakers and researchers alike advocate a "sustainability transition" within these systems — an approach calling for radical rather than incremental change (Grin *et al*., 2010; Farla *et al*., 2012; Markard and Truffer, 2006; Turnheim and Nykvist, 2019). Sustainability transitions are defined as "long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" (Markard *et al*., 2012, p. 956). Firms are expected to deliver product innovations and new business models (Annunziata *et al*., 2020; Ciasullo *et al*., 2019), while government actors are tasked with providing effective policy initiatives to stimulate sustainable innovation (Afeltra *et al*., 2023; Troisi *et al*., 2024) and guiding the transition towards sustainability (Rogge and Reichardt, 2016). At the same time, citizens are encouraged to adapt their consumption habits (Markard *et al*., 2012). However, the transition towards sustainability presents several challenges, including a lack of understanding among firms of the complex and multifaceted nature of the process, the inertia of existing systems, the difficulty of engaging a diverse range of stakeholders with different viewpoints, and obstacles to developing new skills (e.g. van Dokkum *et al*., 2023; Farla *et al*., 2012; La Rocca and Dal Molin, 2024; Markard *et al*., 2012).

Existing literature emphasises the importance of systemic strategies in promoting sustainable sectors and societal systems (D'Angelo and Baroncelli, 2020; Köhler *et al*., 2019; Winch *et al*., 2023). In this context, policymakers play a pivotal role in supporting innovations that drive sustainable transitions. This involves promoting new developments, destabilising entrenched regimes, and preventing technological and institutional lock-in through a variety of policy measures (Ferraris and Grieco, 2015; Rogge and Reichardt, 2016; Turnheim and Nykvist, 2019). Scholars have emphasised the importance of participatory interventions involving not only government actors, but also businesses and civil society (Eklinder-Frick and Åge, 2017; França *et al*., 2022; Silvestri *et al*., 2022; van Dokkum *et al*., 2023).

Against this background, publicly funded innovation networks (PFINs) have emerged as a key policy instrument aimed at facilitating sustainable transitions. Unlike other types of innovation network, PFINs are usually set up by public funding bodies, such as national governments or the European Commission, which provide the necessary financial resources to bring together consortia of different organisations, including manufacturers, research institutes, universities, and consultancies, to work together on innovation projects (Cano-Kollmann *et al*., 2016; Kreye and Perunovic, 2020; Scandura, 2016). While their potential and inherent challenges have been explored in previous studies (Kreye and Perunovic, 2020; Pierrakis and Saridakis, 2019; Rubach *et al*., 2017), relatively little is known about PFINs, particularly in terms of their configuration during the early stages of development. In our study, we therefore focus on the early formation of PFINs, addressing the following research question: What are the perceived needs of stakeholders involved in the early development of a PFIN designed to support a sustainable transition? We focus on the living industry, originally defined as "industry devoted to the needs of living" (Galbraith, 1994), which refers to the sector of the economy concerned with providing housing and related services. The living industry encompasses an integrated ecosystem of products, systems and services that shape and support the development of living spaces. This includes furniture, home décor, interior solutions and environmental systems, such as heating, ventilation and cooling systems, which ensure comfort and functionality. These elements are complemented by a network of installation and craft professionals who assemble, connect and maintain furnishings and technical equipment. Together, these components form a cohesive industry in which design, technology and skilled labour interact to create and continuously improve domestic and professional environments. The broad, interconnected scope of the industry means that value is generated not only through products, but also through their integration, customisation, and long-term use. This study is based on the Italian PFIN initiative Vitality SPOKE 5 [1], which originates from the "Next Generation European Union (EU) Recovery Plan". In the context of the Vitality project, the

scope of the working and living industry is defined as developing innovative, human-centred building solutions that integrate environmental sustainability, economic efficiency, social well-being, multidimensional comfort, and the life cycle of buildings by considering user behaviour and energy consumption patterns. Methodologically, an exploratory qualitative study was conducted involving two focus groups with a total of eleven participants.

Analysis of the findings revealed two types of need relevant to the transition process involving PFIN in the studied territory: (1) the need to enhance the skills and abilities of company staff, and (2) the need to strengthen relationships within a broader ecosystem of stakeholders, including interactions between firms and users, firms and other firms, and firms and policymakers. The findings of this study make a valuable contribution to the literature on sustainability transitions by offering a bottom-up perspective on the needs of the various stakeholders who could be involved in such a process. These needs should inform the activities undertaken within the PFIN during its early development stage, ensuring a more targeted and effective approach to fostering sustainable transitions.

The remainder of the article is structured as follows. Section 2 reviews key contributions concerning the major challenges associated with sustainability transitions, discussing PFINs as participatory policy initiatives that address these challenges. Section 3 outlines the research methodology, detailing the data collection and analysis procedures. Section 4 presents the study's findings. Section 5 discusses the findings and presents the conclusions, while Section 5.3 discusses the study's limitations and outlines directions for future research.

2. Literature background

The literature review is organised into three steps, progressing from a macro to a micro perspective. First, we examine previous research on sustainability transitions and the associated challenges (Section 2.1). Second, we review studies that address the role of policymakers and policy instruments in this context (Section 2.2). Finally, we focus on PFINs, an instrument with significant potential that is still relatively under-explored in the existing literature (Section 2.3).

2.1 Challenges in sustainability transitions

Sustainability transitions integrate environmental, social and economic objectives within organisational systems (Boons *et al.*, 2013). Unlike purely technological transitions, sustainability transitions involve technological advancements, changes in user practices, and changes to institutional structures such as regulatory and cultural frameworks (Markard *et al.*, 2012). While innovations in products and infrastructures may occur (Dijk *et al.*, 2016; Hariyani and Mishra, 2022; Planko *et al.*, 2016), achieving sustainability also requires a transformation in operational approaches.

Despite growing pressure to adopt sustainable practices, transitioning towards sustainability remains complex and challenging (Depken and Zeman, 2018; Tandon *et al.*, 2024). While the ability to acquire, interpret and apply relevant knowledge is critical to sustainability transitions, firms often lack the expertise to identify sustainability-related issues and design and implement effective sustainability initiatives (Tandon *et al.*, 2024). Such knowledge barriers may arise from the "not-invented-here" syndrome, whereby individuals resist adopting knowledge from external sources (Tandon *et al.*, 2024; Snellman *et al.*, 2023). As with any transformative process, existing industries encounter path dependencies and structural lock-ins that impede progress towards sustainability (Markard *et al.*, 2012; Safarzyńska and van den Bergh, 2010; Unruh, 2000). Firms often prioritise survival and attempt to align internal resources with evolving external conditions (Ahmed *et al.*, 2021; Ritter and Pedersen, 2020; Tandon *et al.*, 2024). Another significant challenge relates to firms' limited financial and human resources (HR) (Tandon *et al.*, 2024).

Therefore, achieving sustainability objectives requires organisations to reconfigure their capabilities and processes in order to generate economic, social and environmental outcomes

(Adams *et al*., 2016). This often involves significant investment, research and development efforts, and establishing new partnerships and skill sets (Tandon *et al*., 2024). Sustainability transitions are widely recognised as system-level challenges involving multiple stakeholders that unfold over extended time horizons (Farla *et al*., 2012; Köhler *et al*., 2019; Massaroni *et al*., 2015; Theodoraki *et al*., 2022). However, engaging stakeholders remains a significant challenge (Markard *et al*., 2012; Munten *et al*., 2021), partly due to power and accountability being dispersed across networks of interdependent actors (van Dokkum *et al*., 2023). Transitions are inherently conflictual, involving trade-offs and producing both winners and losers (European Environment Agency, 2019). Incumbents often perceive transformative innovation as a threat and use their power to protect established interests, whereas new entrants typically view alternative socio-technical configurations more favourably and advocate for public support (Köhler *et al*., 2019).

Additionally, different stakeholders (e.g. government, suppliers, customers and employees) often have different goals and opinions on how to achieve sustainable operations. Furthermore, a perceived lack of support from one stakeholder group can negatively influence the commitment of others (Köhler *et al*., 2019; Munten *et al*., 2021; Tandon *et al*., 2024). Also, the inevitable need to share data, knowledge and know-how among stakeholders during the transition process can conflict with individual firms' efforts to protect their critical assets (Munten *et al*., 2021).

Existing socio-technical systems tend to undergo gradual, incremental changes rather than radical transformations. These changes are insufficient to address pressing sustainability challenges (Markard *et al*., 2012). Therefore, policymakers play a pivotal role in tackling these challenges and fostering innovation by allocating financial resources and creating protective spaces for emerging sustainable practices (European Environment Agency, 2025; van Dokkum *et al*., 2023). Government intervention is particularly important in destabilising dominant, unsustainable systems and facilitating the development of alternative socio-technical configurations (van Dokkum *et al*., 2023).

2.2 Policy for a sustainability transition

The role of public policy in driving the transition towards sustainability has been widely investigated in academic literature in recent decades. Several studies have emphasised how policy can encourage innovation, incentivise sustainable practices and address societal challenges (e.g. Köhler *et al*., 2019). Emerging policy approaches aim to create conditions that enable innovation, influence market dynamics and restructure governance mechanisms in order to support long-term systemic change (Rogge and Reichardt, 2016). Researchers have emphasised that sustainability transitions require multifaceted policy interventions that address technological innovation, economic incentives, institutional change and behavioural shifts among stakeholders (Turnheim and Nykvist, 2019). Within this context, policies play a dual role. On the one hand, they support emerging niche innovations through subsidies, R&D investments, tax incentives, technology standards and training. On the other hand, they destabilise existing regimes by discouraging unsustainable practices through taxation or restrictive regulations (Meadowcroft, 2011; Kanger *et al*., 2020; Turnheim and Nykvist, 2019).

Policies are considered to be most effective when they are designed as coherent policy mixes, rather than as isolated interventions (Rogge and Reichardt, 2016). Such policy mixes should incorporate temporal consistency, coherence and comprehensiveness while remaining flexible enough to adapt to evolving technological and socio-economic conditions (Rogge and Reichardt, 2016; Turnheim and Nykvist, 2019). This perspective has drawn increasing attention to the sequencing of policy instruments and the importance of combining policies operating at regional, national and international levels (Kanger *et al*., 2020). It is argued that a balanced approach to steering sustainability transitions requires a combination of technology-push policies (e.g. research grants and technology roadmaps), demand-pull policies (e.g. subsidies, public procurement and market incentives) and systemic interventions (e.g. reforms, infrastructure development and education) (Rogge and Reichardt, 2016). However, despite these efforts,

previous research has shown that the effectiveness of transition policies is undermined by conflicting interests, resistance from incumbent industries, socio-political conflicts and inertia, and economic uncertainties (Meadowcroft, 2011; Turnheim and Nykvist, 2019).

The development of policies that engage a diverse range of societal actors has been recognised as crucial for addressing the complexity and uncertainty inherent in sustainability transitions (Loorbach, 2010), particularly in terms of achieving societal buy-in (Ferraro *et al*., 2015; Schot and Steinmueller, 2018). Traditional hierarchical governance has therefore been supplemented by network-based governance approaches, in which policy decisions are made with the involvement of multiple stakeholders, including governments, businesses, civil society and research institutions (van Dokkum *et al*., 2023). Transition processes do not simply emerge from an uncoordinated interplay of actors pursuing narrow self-interests; rather, they can be strategically shaped — at least to some extent — by players with a broader vision or "larger plans" (Farla *et al*., 2012). To foster effective collaboration among stakeholders in sustainability transitions (Matricano and Sorrentino, 2015), one particularly relevant policy instrument is PFINs, which are discussed in more detail in the following section.

2.3 Publicly funded innovation networks and transition challenges

PFINs are conceptualised as constructed strategic networks (França *et al*., 2022; Möller *et al*., 2005), which may or may not overlap with existing networks and exhibit several distinctive characteristics. Participation is usually based on a deliberate decision to join, and PFINs typically operate within the same geographical area, such as local or regional systems. They generally have a short-to mid-term time horizon and rely on designated coordinating actors (Rubach *et al*., 2017). Some studies further define PFINs as networks that are often initiated by public funding bodies and bring together different stakeholders, such as manufacturers, research institutes and universities, to collaborate on innovation in response to increasing societal challenges, including those related to sustainability (Kreye and Perunovic, 2019, 2020).

PFINs have been conceptualised as a source of innovation, designed to address societal and scientific challenges (Kreye and Perunovic, 2020), as well as to promote innovation within specific regions or industries. The geographical proximity of the individuals involved in PFINs can strengthen their effectiveness, particularly when pre-existing relationships among participants create strong path dependencies shaped by prior collaborations and shared intentions (Kreye and Perunovic, 2019). When promoting the establishment of innovation networks, policymakers carefully consider geographical proximity (Eklinder-Frick and Åge, 2017; Marullo *et al*., 2024). PFINs are therefore considered to be policy instruments for implementing strategic choices by funding targeted innovation activities. PFINs function as a centralised hub for managing and fostering innovation, integrating the contributions of participating organisations. Participants in PFINs tend to be diverse and may include manufacturers, research institutes, universities and consultancies (Kreye and Perunovic, 2019, 2020). Despite their potential benefits, PFINs have also been associated with significant drawbacks. They often operate under heavy administrative structures, which can hinder the achievement of innovative objectives. Furthermore, their overall effectiveness is unclear and has been questioned, with some scholars debating whether PFINs are the most suitable publicly funded instrument for fostering innovation (Kreye and Perunovic, 2020). In summary, research on PFINs is still in its infancy, and more research is needed to understand how they function and which factors should be considered when designing them (Kreye and Perunovic, 2019, 2020).

3. Methodology

3.1 The research context: NRRP Vitality-funded project

This study is empirically part of a larger funded project: Vitality SPOKE 5 (SPOKE 5), titled "Environmental, Economic and Social Sustainability of Living and Working Environments".

This initiative is part of an innovation ecosystem within Italy's National Recovery and Resilience Plan (NRRP). The NRRP programme financed this ecosystem, comprising SPOKE 5 and ten other similar initiatives. The total budget allocated amounts to approximately 1.9 billion euros, to be utilised between 2022 and 2025. Around 120 million euros of this amount has been assigned to SPOKE 5, involving 24 partners located in the central Italian regions of Marche, Abruzzo, and Umbria. These partners include public entities, such as universities and research centres, as well as private organisations.

The programme promotes partnerships among academic institutions, businesses and public agencies by prioritising collaborative efforts, thereby ensuring the scalability and replicability of its outcomes. It is a PFIN designed to address the complex relationship between sustainability and economic development through innovation and cross-sector collaboration. Specifically, SPOKE 5 aims to contribute to the EU's broader sustainability objectives by integrating these efforts.

The initiative takes a holistic approach to sustainability, encompassing environmental preservation, economic advancement and social well-being. The initiative seeks to align technological innovation with sustainability goals, particularly by using digital tools to optimise processes and minimise environmental impact. Furthermore, the innovation ecosystem seeks to improve quality of life in living and working environments.

SPOKE 5's primary objective is to facilitate industrial and social innovation. By providing financial support for research and development (R&D) projects, particularly those led by small and medium-sized enterprises (SMEs), the initiative fosters the development of economically viable solutions that contribute to a greener future. By emphasising the advancement of green technologies, the improvement of urban and workplace environments, and the promotion of sustainable policy frameworks, SPOKE 5 plays a pivotal role in driving the transition towards a more sustainable economy.

These premises establish SPOKE 5 as a valuable research context in which to examine how targeted funding mechanisms can facilitate a sustainable transition. The empirical examination in this study focuses on the early implementation phase of the programme, during which three members of the research team participated in the first of eight work packages designed to achieve the PFIN's objectives. Specifically, the aim of this initial work package was to identify the needs of local stakeholders that were potentially relevant to the PFIN, with regard to factors that could enable the transition towards sustainable living environments within the region. It was expected that the findings from this research would inform subsequent stages of the programme, thereby potentially enhancing its overall effectiveness.

3.2 Research method and data collection

In order to identify the needs of local stakeholders that are potentially relevant to the PFIN, the researchers adopted a qualitative approach and employed focus groups as the primary research method (Morgan, 1996; Stewart and Shamdasani, 2014). The rationale for selecting this method over one-to-one interviews is that focus groups explicitly utilise group interaction as a methodological tool. This interaction enables participants to generate new ideas in response to others' contributions, and the subsequent discussion provides insights into the different group members' positions regarding the phenomenon under investigation (de Souza *et al.*, 2024). Consequently, the research design was exploratory rather than hypothesis-testing (Yin, 2013). Focus groups were therefore considered particularly suitable for exploring the experiences and perspectives of the relevant actors involved (Bonoma, 1985). Participants were selected based on theoretical considerations, specifically the involvement of actors potentially engaged in sustainability transitions within the living industry, as well as convenience and opportunism (Miles and Huberman, 1994). All participants had pre-existing relationships with the university with which some members of the research team are affiliated. Consistent with the regional scope of the PFIN initiative, all participants were drawn from three central Italian regions: Marche, Abruzzo and Umbria. As detailed in Table 1, participants included firms

Table 1. Focus group participants' profiles

Participant	Position	Core business	Industry	Dimension	Brief description
I1	Managing Director	Small home appliances	Electrical appliances	Medium	This Italian company is based in Ancona and specialises in healthcare, personal care and small home appliances. It is known for innovative health-related products and technologies, including rapid tests for CoV-19, and for its role as an Italian agent for Alipay
I2	HR Director	Furniture	Furniture	Large	A leading Italian furniture manufacturer that focuses on modular and customisable solutions for home living, with a particular emphasis on sustainability and modern design
I3	Managing Director	Silver economy start-up accelerator	Finance	Small	A start-up accelerator funded by partners from Italy and other countries. It focuses on accelerating startups that are developing new products and services for the elderly
I4	Corporate Area Manager	Bank 1	Finance	Large	A diversified Italian banking group that offers financial services to businesses and individuals, placing a strong emphasis on personalised solutions
I5	Managing Director	Certification 1	Home appliances and furniture	Small	A technical centre for innovation and technological transfer, offering consulting and project development services in mechanics and related industries
I6	Innovation Manager	Industry association	–	Large	The local branch of the Italian General Confederation of Industry, representing and supporting enterprises in Ancona through advocacy, networking and innovation

(*continued*)

Table 1. Continued

Participant	Position	Core business	Industry	Dimension	Brief description
I7	Managing Director	Certification 2	Home appliances and furniture	Small	An international technology centre dedicated to the furniture and wood industries, providing research, certification and sustainability services. It helps companies to achieve excellence through innovation and compliance with industry standards
I8	Marketing Corporate Manager	Bank 2	Finance	Medium	A regional banking institution in Italy that supports businesses and individuals, with a particular focus on fostering local economic development
I9	Corporate Area Manager	Bank 2	Finance	Medium	A regional banking institution in Italy that supports businesses and individuals, with a particular focus on fostering local economic development
I10	Managing Director	Building Engineering firm	Construction and Engineering service	Small	Known for innovative solutions in engineering and system integration, particularly for energy and industrial applications
I11	Entrepreneur	Plant contractor	Real estate	Small	This platform focuses on smart building technologies and supports consulting engineers and integrators with best practices, system design and cybersecurity for advanced building systems

specialising in furniture and home appliances, as well as innovation hubs, trade associations and other relevant intermediaries. As purposeful sampling was employed (Yin, 2013), the potential for sampling bias associated with opportunistic recruitment must be acknowledged as a limitation. Once identified, participants were invited to take part by the research team via direct contact.

Approximately twenty organisations were approached, of which eleven individuals from ten organisations agreed to participate, while nine declined. Of those who declined, two initially accepted but were ultimately unable to meet the scheduling requirements, while seven formally refused the invitation. In line with the established guidelines for conducting focus groups, we assembled a small yet diverse group of 11 participants from 10 different organisations. Two focus groups were organised and conducted in person at the university,

which offered participants a neutral and familiar environment within a dedicated meeting room equipped with everything needed for group discussions. Each focus group — one consisting of five participants (I1–I5) and the other of six (I6–I11) — lasted approximately two hours. This sample size is consistent with recent studies (e.g. Gebauer *et al*., 2025) and qualitative research guidelines, which suggest that two focus groups are typically enough to reach 80% data saturation (Hennink *et al*., 2019). Data saturation was determined through evidence of information redundancy, whereby no new categories, insights or variations emerged during the analysis (Elo *et al*., 2014; Saunders *et al*., 2018). Saturation was reached with two focus groups because both generated highly consistent patterns and reiterated the same conceptual themes, suggesting that additional groups were unlikely to yield further meaningful contributions. This is consistent with the view that saturation is driven by the richness of the information obtained rather than by sample size alone (Saunders *et al*., 2018).

To encourage balanced participation and ensure that all key topics were explored while avoiding undue influence on participants' opinions, each focus group was facilitated by three dedicated moderators with expertise in qualitative research methods (Tóth *et al*., 2020; Gebauer *et al*., 2025; Morgan, 1996). A lead moderator conducted each focus group, guiding the discussion using a semi-structured interview guide. Two additional researchers were present and intervened when necessary to support the discussion, for example by asking probing questions or requesting concrete examples to encourage participants to expand on their responses. The discussion guide (see Appendix) was designed to elicit participants' views on the territory's readiness to undertake a sustainable transition in living and working environments, and stimulate discussion on the territory's perceived strengths and weaknesses, the barriers to, and opportunities for, developing sustainable solutions, and the resulting needs for fostering sustainable living and working environments. Using a discussion guide (Table A1) ensured consistent coverage of the key research topics across the two groups, while allowing enough flexibility to capture participants' detailed descriptions and emerging insights as the discussion unfolded (Gioia *et al*., 2013). The discussions were audio-recorded and subsequently transcribed to facilitate systematic analysis of the findings (Eisenhardt and Graebner, 2007; Yin, 2013). The research was conducted in accordance with ethical standards, and informed consent was obtained from all participants by having them sign the relevant data and privacy statement.

3.3 Data analysis

As this study focuses on a relatively unexplored phenomenon, a continuous comparison between empirical evidence and existing literature was employed throughout the data analysis process (Dubois and Gadde, 2002; Thompson, 2022; Yin, 2013). This systematic combination of data and theory involved employing a coding strategy in which the data were not forced into pre-existing categories (Christians and Carey, 1989). Instead, emerging concepts were iteratively refined and aggregated into more abstract themes (Strauss and Corbin, 1998). The focus group transcriptions were supplemented by detailed notes taken by the researchers during and after the sessions. Two members of the research team manually coded the collected material through an iterative abductive process. Coding was conducted independently during the first cycle and then compared. Any discrepancies in the application or interpretation of the codes were discussed in dedicated consensus meetings until agreement was reached. If consensus could not be immediately achieved, the coders would revisit the data and analytic memos to reassess the most appropriate coding decision. To further enhance the rigour of the analysis, the coding process and the resulting interpretations were reviewed by the co-authors, who examined the entire procedure and validated the outcomes. This approach is consistent with the recommended procedures for ensuring rigour in qualitative analysis (Elo *et al*., 2014; Pratt, 2008). It is also important to note that none of the authors were insiders, nor did they hold positions or have interests in the organisations involved in the study that could have biased the analysis. Throughout the study and the broader project, the authors acted exclusively in their

capacity as researchers, maintaining neutrality and analytical distance (Elo *et al*., 2014). In line with established qualitative research practices (De Massis and Kotlar, 2014; Miles and Huberman, 1994), the coding process involved inductively aggregating the raw data into categories. The initial coding phase was primarily descriptive, serving to summarise the data and condense the findings. Subsequently, the analysis moved towards identifying first-order concepts, second-order themes, and aggregate dimensions (Gioia *et al*., 2013; see Figure 1). Throughout this process, the researchers kept analytic memos documenting the properties of the coding and any emerging ideas for further discussion (Charmaz and Thornberg, 2023). Several analytical criteria were considered during the coding process, including the frequency of repetition, the number of informants mentioning a given issue, the convergence of views among different informants, and the perceived severity of each issue. A preliminary analysis was conducted between the first and second focus group sessions to refine and steer the research process more precisely (Elo *et al*., 2014). Those responsible for data analysis cycled iteratively between empirical evidence and existing theory to ensure the relevance and robustness of the emerging codes and insights.

The findings indicate that the needs perceived as most important by participants during the focus groups fall under two overarching categories: (1) strengthening internal competencies and skills, and (2) strengthening relationships within a broader ecosystem of stakeholders to support sustainable living and working environments. The following section provides a detailed description of these two dimensions, including the specific themes that emerged within each. To demonstrate the connection between the empirical data and the analytical results, illustrative quotes are presented (Elo *et al*., 2014; Gioia *et al*., 2013), with additional details provided in the Table A2.

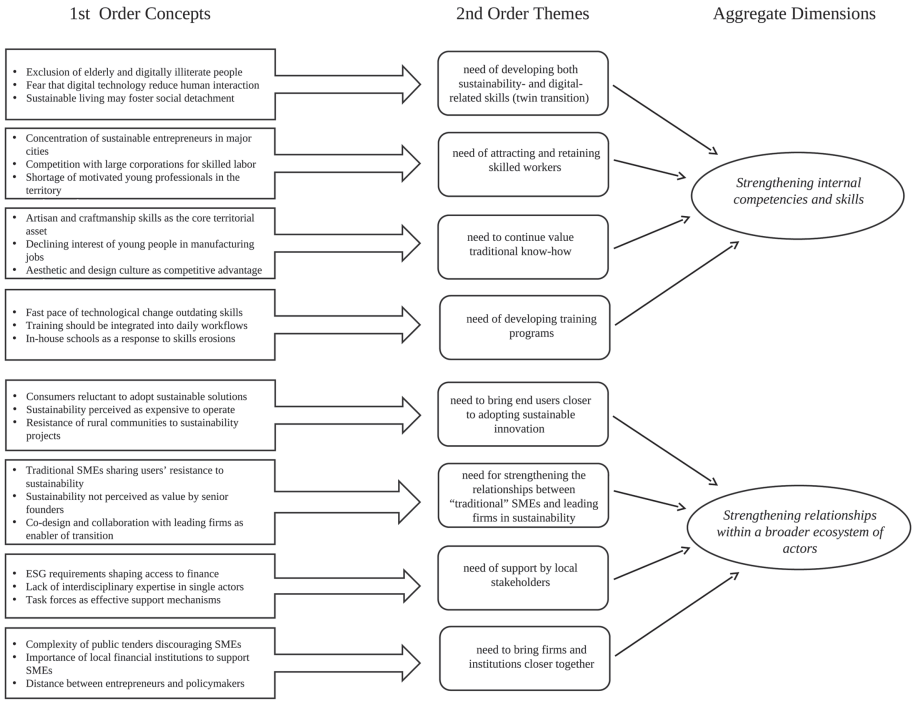

Figure 1. Concepts, themes and aggregate dimensions

4. Findings

4.1 Strengthening internal competencies and skills

The first theme emphasises the importance of developing individuals' skills, particularly in using digital technologies to facilitate sustainability transitions. Participants emphasised that sustainability is closely tied to the "twin transition" – the simultaneous green and digital transformation outlined by the European Commission (2022). A key concern expressed was the potential exclusion of certain groups, particularly the elderly, if digital skills are not developed sufficiently (I1, Managing Director of a small home appliances company). Participants also noted that digital technologies are evolving rapidly and are increasingly shaping both personal and professional spheres. While these technologies offer significant opportunities, they also pose risks, including social alienation and widening generational divides. This creates a paradox: technologies intended to support sustainable living may inadvertently foster social detachment, thereby undermining the principle of social cohesion that sustainability seeks to promote.

Furthermore, a significant generational gap in the use of digital technologies exists in the workplace, particularly between individuals aged 48 to 60 and members of Generation Z. The older group has considerable difficulty adopting digital tools and therefore requires the most support. One participant (I2, HR Director of a furniture company) highlighted another paradox: those who have performed the most physically demanding and hazardous manufacturing tasks are often unable to benefit from technologies designed to alleviate physical strain, such as collaborative robots or wearable devices. In contrast, young workers, who are highly proficient with digital tools, are at the forefront of adopting these technologies. However, their view of work differs markedly from that of previous generations. As I2, the HR Director of a furniture company, explained: *Younger employees prioritise work-life balance, shorter working weeks and hybrid or fully remote working arrangements. Today's job applicants are less concerned with salary and more interested in flexible working conditions. Entrepreneurs must therefore recognise these shifting expectations and develop strategies to address them effectively.* This issue is particularly relevant in industrial districts, which predominantly comprise small enterprises and, to a lesser extent, medium-sized ones. In these contexts, technological investments are not usually intended to replace human labour. However, older individuals often lead management teams and struggle to adapt to new technologies and evolving work practices, such as remote working.

A second need arising from the first theme is the attraction and retention of skilled professionals within the region. While companies in these districts have expertise rooted in long-standing traditions, such as furniture and home appliance manufacturing, they lag behind in the competencies required to develop start-ups that drive sustainable transitions through new technologies. One participant emphasised a geographical challenge: *While the territory does not lack skilled individuals, it struggles to attract sustainable entrepreneurs, who tend to be more concentrated in advanced innovation hubs such as Milan or Rome* (I3, managing director of a silver economy start-up accelerator).

While the small size of companies and towns was seen as a barrier to attracting professionals, particularly young graduates, some participants suggested that the high quality of life could be used as a competitive advantage. At the same time, however, participants expressed concern that large companies pose a threat to local businesses. As one participant noted: *Small entrepreneurs, who have long served as training grounds, struggle to retain workers due to competition from big players . . . Losing even two or three key workers is a huge issue* (I9, Corporate Area Manager, Bank 2). Large corporations, such as Amazon, which is currently establishing one of the largest European facilities in the region, can offer higher salaries and better working conditions, including benefits such as remote working and on-site childcare. This makes it difficult for smaller firms, which dominate the local economy, to attract and retain skilled professionals, including warehouse workers.

A third topic that emerged from the participants was the need to value traditional know-how. While respondents emphasised the *region's solid and deeply rooted know-how*

(I6, Innovation Manager of an industry accelerator), they also highlighted the need to support established manufacturing firms by developing technologies that would make them more competitive. As one participant explained: *You have to start with what firms know and are able to create. Within industrial districts, firms know how to manufacture products. This is what makes our territory attractive, even to large companies that rely on local firms as subcontractors* (I5, Managing Director, Certification 1). For example, with regard to the furniture industry, participants discussed the substantial knowledge gap concerning the recycling of production scraps, and emphasised the potential of providing innovative solutions to address this issue.

Another issue is the difficulty that firms, especially SMEs, face in recruiting individuals who are both trained and willing to work in manufacturing. Participants noted that Generation Z, being highly digitally oriented, shows limited interest in traditional manufacturing careers. They emphasised the need to make traditional manufacturing industries, such as furniture manufacturing, more appealing to younger generations by emphasising technology, sustainability, design, and aesthetics. As one participant reflected: *Cultivating an appreciation for beauty and aesthetics from an early stage in education could serve as a significant yet underutilised competitive advantage for these industries. While technological advancements, such as immersive experiences enabled by devices like the Oculus Rift [a virtual reality technology], open up new possibilities, physical living spaces remain essential. The design and character of one's home play a critical role in personal expression and overall well-being* (I2, HR Director of a furniture company). Participants emphasised that this message should be communicated more effectively, particularly to younger generations, to highlight the enduring value of well-designed, tangible living environments.

The final topic to receive considerable attention was the tools and strategies for addressing competency-related challenges. Participants emphasised the importance of enhancing training programmes to better align with the evolving needs of workers. A major challenge lies in promoting and facilitating access to training opportunities, including publicly funded programmes, in a more efficient and inclusive manner. In the manufacturing sector, where work schedules and production demands are becoming more challenging, integrating dedicated training programmes is difficult. As I1 (Managing Director of a small home appliances company) noted: *Digital technologies and sustainable initiatives are developing at such a fast pace that, in order to train the entire workforce, the company would have to stop working*. To overcome this issue, training initiatives should be designed to integrate seamlessly into existing workflows, enabling employees to acquire new skills without compromising operational efficiency. Training activities are also considered essential in encouraging younger generations to pursue jobs that have become increasingly unattractive, such as blue-collar roles in craft-based manufacturing industries and technical sectors, such as plumbing and construction. Participants viewed the establishment of in-company training schools as an effective way of addressing these skill gaps (I4, Corporate Area Manager of Bank 1) and they also acknowledged that training is essential not only for workers and entrepreneurs but also for consultants as *"without the right skills, no one can guide companies in understanding their environmental impact, identifying areas for improvement, and structuring a real plan"* (I8, Marketing Corporate Manager of Bank 2).

4.2 Strengthening relationships with relevant stakeholders

Participants acknowledged that, while firms are keen to innovate in the direction of sustainability, end users are reluctant to adopt innovations that are oriented towards sustainability. Consequently, the primary need identified is to educate users to foster greater acceptance of sustainable solutions. Participants noted that, while many companies are investing in new technologies and sustainability initiatives, the lack of consumer readiness often hinders the immediate application of these initiatives, whether in the modification of

existing products or the development of entirely new ones. Nevertheless, there was a consensus that the collective effort to enhance the sustainability of living and working environments (e.g. homes, boats and cars) is a key strength of the territory, with both established firms and start-ups actively engaged in this transition. However, participants emphasised that users are far less engaged than companies in adopting sustainable innovations. One participant illustrated this point: *We are used to having consumption, comfort and air quality metres in our cars. Yet when we buy a house, do we really ask if there is a metre to measure consumption? We only obtain the APE (Attestazione Prestazione Energetica - the Italian Energy Performance Certificate) because it's mandatory. There is also a lack of consumer engagement in this evolving concept of living. As end users, we are not sufficiently involved in shaping and embracing these changes, which limits the potential impact of innovative approaches to design, sustainability and functionality in our living spaces. Citizens still need to understand what sustainable living means* (I11, Entrepreneur, Plant Contractor). Participants observed that, despite the availability of apartments equipped with photovoltaic systems, heat pumps and storage units, these technologies are often considered too costly to operate. Consequently, companies continue to install traditional systems, such as boilers and radiators, to meet users' preferences. This reflects a broader challenge in taking effective action to improve the territory's sustainability. Participants shared that, even when tenders are awarded, realising sustainability-oriented projects remains difficult, particularly in rural areas where residents may not value such initiatives. As one participant explained: *You can design projects and ideas to improve rural areas, such as e-bike trails, but to implement them you may need to acquire land, and locals can pose a significant obstacle. Even if there is money to improve these areas, it is far from easy* (I10, managing director of a building engineering firm).

Consequently, companies often invest in sustainability to enhance their visibility and reputation within their industry and supply chains, rather than in response to direct market demand for specific products and services. By demonstrating a commitment to reducing their environmental impact, improving workplace conditions, and enhancing employee well-being, businesses can position themselves as responsible and forward-thinking actors in an increasingly sustainability-conscious context. The importance of visibility was emphasised by one participant: *These efforts are usually displayed in the corporate social responsibility report, even for those firms that are not required to have such documents* (I9, Corporate Area Manager, Bank 2).

Adding to this complexity, participants noted that not all firms are moving in the same direction. Traditional SMEs in the region, in particular, often share a similar mindset to end users, displaying reluctance to proactively integrate sustainability as a strategic priority. As one participant explained: *Many small and medium-sized companies were founded by one individual with a vision for the future. The entrepreneurial fabric is made up of excellent craftsmen with an average age of between 65 and 70. Yet these firms lack the structure to take the entrepreneur and their company into the future. These entrepreneurs do not see the value of sustainability and innovation* (I8, Marketing Corporate Manager, Bank 2). However, where a generational shift has occurred, the situation appears different, with "new" entrepreneurs investing in sustainable initiatives, particularly in the social sphere (e.g. financing theatrical seasons, kindergartens, and other projects aimed at enhancing the local area). However, many firms are unable to manage such transitions independently, so progress largely depends on leading companies' influence through co-design activities and collaborative projects. This discussion highlighted a second key need: strengthening relationships between traditional SMEs and leading firms to foster sustainability-oriented innovation.

To achieve this, companies must collaborate with a diverse range of stakeholders, including chartered accountants, tax consultants, technology providers and banks, who can help them to assess environmental impacts. A third key need that emerged from the discussion is the establishment of stronger synergies among companies, technology suppliers, financial institutions and other relevant stakeholders. Leveraging the expertise of these stakeholders enables firms to identify appropriate tools and strategies more effectively, navigate the

complexities of sustainability, and integrate meaningful, long-term solutions into their operations. One topic of discussion was the growing importance of environmental, social and governance thresholds, which are increasingly becoming a requirement for companies, particularly in relation to credit scoring and bank ratings. As one participant emphasised: *Granting finance is increasingly linked to compliance with these rules. The rules of the game must be clear to all stakeholders* (I4, Corporate Area Manager, Bank 1). Participants emphasised that the economic dimension of sustainability is fundamental for businesses. As one participant explained: *Sustainability today is a philosophy and a way of life. It is a necessity for companies and individuals alike to safeguard and improve the world. For an entrepreneur requesting a photovoltaic system or the technological modernisation of plant systems, the economic sustainability of such interventions must also be considered. A savvy entrepreneur knows that the bank wants its money back. Therefore, finding a bank that can assess the feasibility of investments is essential* (I11, Entrepreneur, Plant Contractor). Firms should be supported by an ecosystem of different stakeholders, such as universities, research centres and trade associations, who can contribute specific expertise in areas such as product knowledge, certification, financial analysis and academic research. As one participant observed, *Task forces of actors that adopt an interdisciplinary approach are needed* (I7, Managing Director, Certification 2). These task forces should integrate multiple skills and perspectives in order to assess firms' needs and design concrete development pathways. The relationship between entrepreneurs and these supporting actors is considered pivotal. Participants also discussed the role of banks, noting that decision-making centres are now largely concentrated in major cities. This centralisation was considered a major drawback for entrepreneurs and the local area. Despite the increasing digitalisation of banking operations, particularly for medium and large companies, entrepreneurs expressed frustration over the lack of nearby physical branches. As one participant remarked: *A bank owned by a local foundation is good because part of its profits is reinvested in the local area* (I8, Marketing Corporate Manager, Bank 2).

The fourth and final topic that emerged from the discussions concerns the need to strengthen relationships between firms and institutions. Small and micro companies often struggle to assert their interests without external guidance. As one participant noted: *Sending a small firm to the European negotiation table is difficult. It takes time to understand the context in which it operates. This means that such a firm has to stop doing its job and learn to do something completely different. Firms lack the time to do so* (I5, Managing Director Certification 1). Yet firms and institutions appear increasingly distant from one another. Participation in public tenders, for example, is often considered too complex because those who design them are not always aware of how they will be implemented in practice, which makes them difficult for applicants to navigate. This misalignment between institutional design and business operations creates a structural gap that participants say remains challenging to bridge.

5. Discussion and conclusions

5.1 Contribution to theory

In light of the many challenges associated with sustainable transitions, establishing PFINs is a vital policy intervention that can facilitate this process, especially in situations involving various stakeholders with different objectives. While previous studies have examined the role of such policy initiatives (e.g. Kreye and Perunovic, 2020; Pierrakis and Saridakis, 2019; Rubach *et al*., 2017), this study is original in focusing on the early stages of such projects, an aspect that has been overlooked in existing research. Specifically, this study makes several contributions to the literature, as summarised in Table 2.

Firstly, this study adopts a bottom-up approach to identify the emerging needs of potential network participants. This approach is particularly valuable for determining which elements should be prioritised to ensure publicly funded innovation initiatives achieve their intended

Table 2. Overview of the study's contributions

Area of literature	Focus in existing studies	*Contribution of this study*
Publicly funded innovation networks (PFINs)	PFINs are primarily examined as established policy instruments supporting innovation and collaboration outcomes (Kreye and Perunovic, 2019, 2020; Rubach *et al*., 2017)	Shifts attention to the early-stage formation of PFINs, demonstrating that network effectiveness is shaped by design choices and actor needs identified before formal implementation
Sustainability transitions	Sustainability transitions are conceptualised as systemic and multi-actor processes, often analysed at meso or macro levels (Köhler *et al*., 2019; Farla *et al*., 2012)	Extends this literature by integrating a micro–meso perspective, linking organisational capabilities with network-level dynamics in early transition phases
Actor needs and network design	Limited consideration of bottom-up identification of participant needs in publicly funded initiatives (França *et al*., 2022; Eklinder-Frick and Åge, 2017)	Introduces a bottom-up approach to identifying emerging actor needs, highlighting its relevance for prioritising interventions and improving policy effectiveness
Organisational capabilities for sustainability	Emphasis on firms' reliance on external networks to overcome sustainability-related knowledge gaps (Hariyani and Mishra, 2022; Söderholm *et al*., 2019)	Highlights the importance of internal capability building, including skills development, targeted training, and talent attraction, as a prerequisite for effective participation in PFINs
Path dependence and innovation	Path dependence is recognised as a barrier to sustainability transitions (Ritter and Pedersen, 2020)	Shows how PFINs can help balance traditional expertise and openness to new paradigms through targeted training and networking, mitigating path-dependent dynamics
Ecosystem relationships	Networks are viewed mainly as coordination mechanisms among firms and institutions (Möller *et al*., 2005)	Conceptualises PFINs as arenas for alignment among firms, users, policymakers, and regional stakeholders, emphasising multi-level and relational dynamics
Territorial and governance perspectives	Limited attention to the geographical and territorial dimensions of PFIN governance (Marullo *et al*., 2024)	Demonstrates the importance of geographical proximity and localised decision-making for tailoring sustainability and innovation strategies to regional contexts
Methodological approaches	Lack of insights on methodological approaches to be considered in designing PFIN	Establishes focus groups as a valuable qualitative method for exploring early-stage PFINs and facilitating shared understanding among potential participants

outcomes. This issue is highly relevant because, despite the recognised benefits of establishing PFINs, their overall effectiveness remains uncertain. Scholars have questioned whether PFINs are the most appropriate publicly funded instrument for fostering innovation (Kreye and Perunovic, 2020). Therefore, understanding the conditions under which these initiatives can produce meaningful results is crucial for evaluating their role within broader innovation and sustainability policies. The findings of this study highlight two key types of need: (a) strengthening organisations' internal skills and competencies, and (b) reinforcing relationships within the broader ecosystem of actors, involving interactions at multiple levels: firms-to-users, firms-to-firms, and firms-to-policymakers.

In this regard, prior literature has shown that the transition towards sustainable models is often hindered by a limited understanding of sustainability and the specific actions required for its implementation among companies, as well as by a shortage of qualified workers

(Tandon *et al*., 2024). While existing literature highlights how companies address this challenge by leveraging networks of external firms (Farla *et al*., 2012; Köhler *et al*., 2019), this study contributes to the discussion by emphasising the importance of investing in employees' professional development through targeted training initiatives. Furthermore, it emphasises the need to increase the appeal of the region and its firms to attract skilled professionals, encourage cross-regional knowledge exchange and reduce the loss of qualified talent to more competitive areas. Additionally, the study emphasises that to mitigate the impact of path dependence on the transition towards sustainability (Ritter and Pedersen, 2020; Safarzyńska and van den Bergh, 2010; Tandon *et al*., 2024), PFINs must strike a balance between leveraging the traditional expertise of established companies and adopting new technologies and paradigms with an open mind. This requires targeted training and networking efforts to facilitate knowledge exchange, stimulate innovation, and enable traditional firms to effectively integrate sustainable practices while preserving their core competencies.

The study emphasises the importance of addressing sustainability as a systemic issue, particularly within the context of a PFIN. Although previous literature has emphasised this systemic perspective (e.g. Köhler *et al*., 2019; Kreye and Perunovic, 2019; Massaroni *et al*., 2015; Theodoraki *et al*., 2022), our findings highlight the importance of strengthening relationships across a wider network of stakeholders. Notably, the study emphasises the importance of aligning companies and citizens around the concept of sustainability. Even when companies are eager to innovate, they often struggle to engage customers who are not yet ready to adopt sustainability-oriented innovations. Furthermore, the study demonstrates that actively involving regional stakeholders, such as businesses, institutions and research centres, can enhance knowledge sharing, reduce barriers to innovation and create a more integrated approach to sustainability. In this regard, policymakers should carefully consider geographical proximity when promoting the formation of PFINs (Eklinder-Frick and Åge, 2017). Such collaboration is essential for ensuring the effective dissemination of sustainability-related knowledge within the business community.

Another contribution of this study is its confirmation of the importance of fostering closer connections between the business sector and institutions within the systemic perspective that characterises the sustainable transition, given the diverse perspectives and interests of those involved (van Dokkum *et al*., 2023; Turnheim and Nykvist, 2019). A key issue is the geographical location of decision-making centres. When decision-making authority is concentrated far from the areas where transformation is intended to take place, it becomes difficult to design strategies and instruments that adequately reflect the specific needs and aspirations of the local area (La Rocca and Dal Molin, 2024). Adopting a more unified and effective strategy requires decisions to be made in close collaboration with stakeholders who have an in-depth understanding of the region's unique characteristics and potential. Aligning stakeholders operating within the same regional context could enhance the effectiveness of PFINs' initiatives, ensuring that sustainability policies and innovation strategies are better tailored to the territory's specific needs and dynamics.

Another key contribution of this study is its use of focus groups to explore publicly funded innovation projects. The findings suggest that this approach is particularly valuable in the early stages of establishing a PFIN, as it emphasises the importance of facilitating preliminary discussions among interested parties. These meetings help to identify and prioritise key concerns, ensuring that the network is established on a solid foundation of shared understanding.

5.2 Implications for management and policy

Based on these findings, the study identifies a set of key intervention areas, actions and responsible parties, as shown in Table 3. This provides a comprehensive overview of how PFINs can be designed to effectively support sustainable transitions.

The first area of intervention involves developing internal skills and competencies through training programmes. To this end, key stakeholders involved in PFIN, including firms, training

Table 3. Areas of intervention, concrete actions, and responsible actors in early-stage PFIN formation

Area of intervention	Concrete actions	*Responsible actors*
Development of internal skills and competencies	Design and deliver targeted training programs on sustainability, innovation management, and emerging technologies; support continuous professional development for employees	Firms; Training providers; Universities
Attraction and retention of qualified talent	Implement incentives to attract skilled professionals; enhance the attractiveness of the region and local firms; promote mobility and cross-regional knowledge exchange	Policymakers; Regional authorities; Firms
Mitigation of path dependence	Facilitate exposure to new technologies and paradigms while valuing existing expertise; promote experimentation and learning through pilot projects	Firms; Research centres
Firm–user alignment around sustainability	Engage citizens and users through awareness campaigns, co-creation activities, and dialogue on sustainability-oriented innovations	Firms; Local communities; Civil society organisations
Strengthening firm–firm collaboration	Create networking opportunities, collaborative projects, and shared learning spaces to foster trust and knowledge exchange among firms	Firms; Industry associations
Strengthening firm–policymaker interaction	Establish regular dialogue between firms and policymakers; co-design policies and instruments aligned with firms' needs	Policymakers; Firms
Engagement of regional stakeholders	Actively involve regional institutions, research centres, and intermediary organisations to support coordination and diffusion of sustainability knowledge	Regional authorities; Research centres; Intermediaries
Territorially embedded governance	Ensure decision-making centres are closely connected to the regional context; tailor strategies and instruments to local characteristics	Policymakers; Regional authorities
Early-stage stakeholder alignment	Organise preliminary focus groups and workshops to identify priorities, concerns, and shared goals before formal network establishment	Policymakers; Potential network participants

providers and universities, should collaborate to design and deliver targeted training programmes focusing on subjects that support sustainable transitions (e.g. sustainability, innovation management and emerging technologies) (Galvani *et al.*, 2025). These programmes should integrate continuous professional development initiatives for employees.

The second identified area is related to the need to enhance talent attraction and retention at a regional level. Regional policymakers, local institutions and firms can play a central role in this by developing incentives, clear career pathways and employer branding initiatives aimed at attracting and retaining skilled professionals. These initiatives aim to reduce the outflow of qualified talent and enhance knowledge circulation at a regional level.

The third key area of intervention involves mitigating path dependence, which can hinder firms' ability to engage in sustainability-oriented innovation. Firms, universities, and research centres should collaborate to exchange knowledge between established companies and more innovative organisations. Joint projects, experimental initiatives and exposure to new technological paradigms developed through these collaborations could help firms balance their traditional expertise with a more open and forward-looking approach.

The interface between firms and users is the fourth critical intervention area. In collaboration with local communities, firms should engage citizens and end users through awareness-raising campaigns, co-creation activities and pilot projects. The aim of these initiatives is to increase acceptance rates of sustainability-oriented innovations and align market demand with firms' innovation efforts.

The fifth area of intervention is inter-firm collaboration. Firms participating in PFIN can strengthen collaboration and trust by organising networking events, supporting joint projects and creating platforms for knowledge sharing to facilitate interaction and collective learning among participating organisations. Such initiatives facilitate the transfer of knowledge across networks (Baraldi *et al*., 2020; La Rocca *et al*., 2017), reducing fragmentation within the network and enhancing its effectiveness. Policymakers and firms should establish an ongoing dialogue to enable continuous information and knowledge exchange. This will allow sustainability and innovation policies to be adjusted according to emerging challenges and opportunities identified by PFIN participants. Policymakers should consider PFIN dynamics (Söderholm *et al*., 2019), which can create collaborative opportunities while also generating conflicts and tensions. Therefore, they must provide greater opportunities for confrontation, within which interactive and participatory decision-making processes can be developed and supported (Guercini *et al*., 2024).

Another important area of intervention is the active engagement of regional stakeholders. To enhance knowledge sharing, foster innovation diffusion and support a more integrated regional approach to sustainability transitions, regional authorities should actively involve universities, research centres and public institutions in network activities. Finally, early-stage stakeholder alignment is a cross-cutting area of intervention that underpins the effectiveness of all the others. Prior to the formal establishment of PFINs, policymakers, firms, and other relevant stakeholders should organise exploratory activities such as focus groups and preliminary meetings. These initial interactions help to identify shared priorities, align expectations and ensure that the PFIN is established on a solid foundation of mutual understanding and collective commitment.

5.3 Limitations and future research directions

This study provides a much-needed, bottom-up perspective on sustainable transitions, examining the needs of potential stakeholders in this process within the living industry in the context of a PFIN. Although our research focuses on sustainability issues within the living industry, we believe that, consistent with the concept of transferability in qualitative research (Lincoln and Guba, 1985), the study's findings may be applicable to similar contexts. For example, they could be applied to other publicly funded innovation initiatives that support sustainable transitions in local settings through a network-based approach. However, we acknowledge that this study is subject to limitations relating to the scope and availability of the data. To address this limitation, future research could conduct comparative analyses and organise focus groups in other regions of the same country or across different countries. In order to extend data collection and potentially achieve 90% data saturation, it is recommended that future studies increase the number of focus groups to four or five (Hennink *et al*., 2019). Furthermore, future studies should include firms of various sizes — large, medium and small — to capture potential variations in organisational structures. Including additional stakeholders such as local universities, research centres, end users (e.g. civil society members and households) and policymakers at regional and national levels would also benefit the research, providing a more comprehensive understanding of the dynamics shaping the sustainable transition. Furthermore, including additional participants could provide a deeper insight into the differences in perspectives between stakeholder groups.

Additionally, future research could focus on the specific requirements for joining and developing successful sustainability networks, building on the findings of this study to enhance our understanding of the role of PFINs in driving sustainable transitions. This study examines the very early stages of PFIN development, focusing on the needs of the key stakeholders involved in the ongoing transition process who may participate in the emerging PFIN. As the Vitality project is ongoing, future studies could investigate how it evolves and whether insights from the actors' needs analysis are incorporated into subsequent PFIN development stages.

Furthermore, exploring potential synergies and/or tensions between the constructed PFIN and existing, organically formed business networks would be valuable. This would contribute

to the debate on the differences between emergent networks (Halinen and Törnroos, 1998), and constructed networks (Baraldi *et al.*, 2022) such as PFINs. Similarly, to strengthen the empirical evidence of how such initiatives contribute to sustainable transitions, and to help policymakers design more effective measures, future research should conduct ex post analyses of the outcomes of the Vitality project and similar initiatives linked to PFIN development.

Note

1. In the Italian National Recovery and Resilience Plan (NRRP)-funded Innovation Ecosystems, a "Spoke" refers to a thematic research and innovation pillar coordinated by a leading institution within the ecosystem. Spoke 5 specifically focuses on the environmental, economic and social sustainability of living and working environments.

Appendix

Table A1. Discussion guide

Formulation of the question
Q1 When we talk about sustainability in living and working environments, what comes to mind?
Q2 What characteristics define a sustainable living and working environment?
Q3 What strengths within the region do you perceive as particularly relevant for the development of sustainable living and working environments?
Q4 What weaknesses does the region face in developing sustainable living and working environments?
Q5 What opportunities could arise from the development of products and services for sustainable living and working environments?
Q6 What challenges might companies encounter when developing products and services for sustainable living and working environments?
Q7 Are companies in Marche, Umbria, and Abruzzo prepared to undertake this process of change?
Q8 How can local companies be supported in developing products and services for sustainable living and working environments?
Q9 How can the development of sustainable living environments contribute to improving rural areas in the involved regions? (*Optionally, ask which stakeholders could play a key role.*)
Q10 Considering the topics discussed today, what are the most relevant points that emerged?

Supplementary

Table A2. Illustrative quotes

Strengthening internal competencies and skills – Illustrative quotes
Theme: Need of developing both sustainability- and digital-related skills (twin transition) *Hearing all these different viewpoints has made me realise that there's another problem I face, even at 53: the gap created by new technology. My mother, for example, can't turn on a smartphone, and she is one of many people who are not digitally literate. So, when things move too fast, a whole group of people gets left behind. At work, I bought VR headsets for everyone to try, but some people were a bit scared and wondered if a "future world" where you sit at home drinking virtual beer with friends might replace real human interaction. That's part of sustainability, too: ensuring technology doesn't isolate people or replace human contact*. (I1, Managing Director of a small home appliances company) *At my manufacturing company, you can really see what we mean about the sustainability of the technological transition. . . . There's a real generational fracture. On one side, you have people close to retirement, who you mainly try to accompany. But then there's the 50–60 group who still have a long way to go, and it's tough for them to adapt to new tech—collaborative robots included. Ironically, they're also the ones who've damaged their backs doing repetitive work for years, when robots weren't around, and now that robots exist, they can't use them.* (I2, HR Director of a furniture company)

(*continued*)

Table A2. Continued

Strengthening internal competencies and skills – Illustrative quotes
Younger employees prioritise work-life balance, shorter working weeks and hybrid or fully remote working arrangements. Today's job applicants are less concerned with salary and more interested in flexible working conditions. Entrepreneurs must therefore recognise these shifting expectations and develop strategies to address them effectively. (I2, HR Director of a furniture company)
Technology is interesting today, for example in homes and factories, but there has been no real cultural shift yet. Even when measurement systems or other digital tools are introduced, they only work if people know how to use them and recognise their value. Many people still lack the knowledge to understand how these technologies can improve comfort, energy efficiency and processes, so we still lack the ability to truly engage with this new concept of living and working sustainably. Without these skills, innovation struggles to take root. (I11, Entrepreneur, plant contractor)
In many cases, the fiscal incentive triggers technological investment, but we observe that companies still need to develop the skills to understand these tools properly. The introduction of technology is not intended to replace personnel, but rather to enhance safety, productivity and service quality. However, without the right competencies, many firms cannot leverage digital systems and sustainable innovations to their full potential. (I9, Corporate Area Manager, bank 2)
Theme: Need of attracting and retaining skilled workers
While the territory does not lack skilled individuals, it struggles to attract sustainable entrepreneurs, who tend to be more concentrated in advanced innovation hubs such as Milan or Rome. (I3, Managing Director of a silver economy startup accelerator)
Small entrepreneurs, who have long served as training grounds, struggle to retain workers due to competition from big players . . . Losing even two or three key workers is a huge issue. (I9, Corporate Area Manager, bank 2)
There are plenty of opportunities here because the quality of life is very high. However, the critical issue is that people are missing. New generations view work completely differently, and there is an increasing divide between them, companies and institutions. As we expected, the research revealed that we lack people, especially those motivated to stay in this territory. (I2, HR Director of a furniture company)
The key issue is attractiveness. Although the number of companies in our sector has decreased due to consolidation, we produce more furniture than in the past. However, international players are now showing more interest than ever in the Pesaro district. This is why we need to make the area appealing to talent; otherwise, we won't be able to maintain this positive trend. (I5, Managing director certification 1)
Theme: Need to continue value traditional know-how
You have to start with what firms know and are able to create. Within industrial districts, firms know how to manufacture products. This is what makes our territory attractive, even to large companies that rely on local firms as subcontractors. (I5, Managing Director certification 1)
When it comes to competencies, it almost feels too obvious to say, but they're all here: In training, manufacturing and services. We lack nothing. The expertise in this region is solid and deeply rooted. (I6, Innovation manager of an industry accelerator)
The district used to be a paradise. However, it was demonised due to issues such as closure and self-sufficiency. Then, due to international competition, it was forced to open up. Now, we're in a phase where we don't really know what the district is anymore. Each situation should be analysed separately. However, the district's heritage — its know-how, mindset and production culture — still matters and must not be lost. (I7, Managing director certification 2)
Traditional craftsmanship is disappearing, and companies are feeling the loss acutely. Consider [name of a company], for example: despite having an annual turnover of almost one billion, they are struggling because artisanal skills are fading. They have responded by creating in-house training schools for young people, mostly from abroad, because many Italian young people no longer want to work in these roles, even when the working conditions are excellent. This demonstrates the importance of preserving and regenerating traditional expertise. (I4, Corporate Area Manager of Bank 1)
In our district, most entrepreneurs are, above all, excellent craftsmen. Many built their companies based on a specific skill. However, this expertise is at risk of disappearing, particularly where there has been no generational turnover. It is essential to safeguard these skills because many manufacturing activities simply cannot be delegated to machines. (I9, Corporate Area Manager, bank 2)

(*continued*)

Table A2. Continued

Strengthening internal competencies and skills – Illustrative quotes
Cultivating an appreciation for beauty and aesthetics from an early stage in education could serve as a significant yet underutilised competitive advantage for these industries. While technological advancements, such as immersive experiences enabled by devices like the Oculus Rift [a virtual reality technology manufactured by Oculus VR], open up new possibilities, physical living spaces remain essential. The design and character of one's home play a critical role in personal expression and overall well-being. (I2, HR Director of a furniture company)
There is a significant shortage of skilled workers in many sectors, including plumbing, electrical work and artisanal crafts. While a structured enterprise can offer more value thanks to its technical knowledge and ability to guide clients, if we lose the traditional skills that underpin these sectors, technology alone won't be enough to replace them. (I11, Entrepreneur, plant contractor)
Many of our entrepreneurs are highly skilled craftsmen, and they built their companies on those skills. However, if generational change does not take place, we risk losing this heritage. Young people often do not want these roles, even when the working environment is excellent. This makes preserving craftsmanship a real challenge for the future of the area. (I8, Marketing Corporate Manager of Bank 2)
Theme: Need of developing training programs
In the manufacturing sector, it is becoming increasingly difficult to keep up with the pace of change, particularly with regard to training. Digital technologies and sustainable initiatives are developing at such a fast pace that, in order to train the entire workforce, the company would have to stop working. The core of the problem is that interrupting production is not an option for us. This is why training programmes must be redesigned to integrate directly into existing workflows, enabling employees to develop new skills without compromising operational efficiency. (I1, Managing Director of a small home appliances company)
We organised training courses for everyone, which were funded by the region. Training is essential, but each time a new system or technology is introduced, it requires a significant learning effort from the staff. There is a risk of slowing down operations while trying to keep everyone up to speed. (I1, Managing Director of a small home appliances company)
There is a significant cultural divide. Many of our entrepreneurs are aged between 65 and 70, and their business is often an extension of themselves. They lack structured administrative or managerial support, and when faced with Industry 4.0 or sustainability initiatives, they only consider the tax benefits rather than the long-term strategic value. Training is essential for both entrepreneurs and consultants because, without the right skills, no one can guide companies in understanding their environmental impact, identifying areas for improvement, and structuring a real plan. (I8, Marketing Corporate Manager of Bank 2)
The most virtuous examples are those in which companies have created internal schools to train workers. Without proper training, it is impossible to replace traditional skills that are being lost or to prepare employees for new technological environments. This is becoming a strategic necessity across many sectors. (I4, Corporate Area Manager of Bank 1)
Honestly, the only way forward is to invest as much as possible in training, especially that supported by public funding. We participate in these programmes from time to time, but the system tends to be too superficial at first and then becomes overly bureaucratic, which is a typical Italian problem. Simplifying access to training funds would make a huge difference. The challenge is that manufacturing companies operate to tight schedules and have strict workflows, so it is difficult to find time for necessary training. I'm fortunate to work with an entrepreneur who recognises the value of training, but many smaller firms simply can't afford to halt production for half a day or request that employees come in on a Saturday. That's why targeted training, especially for the age group I mentioned earlier that is struggling the most with new technologies, would help both workers and companies learn to navigate this technological transition together. (I2, HR Director of a furniture company)
Strengthening relationships within a broader ecosystem of actors – Illustrative quotes
Theme: Need to bring end users closer to adopting sustainable innovation
We are used to having consumption, comfort and air quality metres in our cars. Yet when we buy a house, do we really ask if there is a metre to measure consumption? We only obtain the APE (the Italian Energy Performance Certificate) because it's mandatory. There is also a lack of consumer engagement in this evolving concept of living. As end users, we are not sufficiently involved in shaping and embracing these changes, which limits the potential impact of innovative approaches to design, sustainability and functionality in our living spaces. Citizens still need to understand what sustainable living means. (I11, Entrepreneur, plant contractor)

(*continued*)

Table A2. Continued

Strengthening relationships within a broader ecosystem of actors – Illustrative quotes
You can design projects and ideas to improve rural areas, such as e-bike trails, but to implement them you may need to acquire land, and locals can pose a significant obstacle. Even if there is money to improve these areas, it is far from easy. (I10, Managing Director of a building engineering firm)
Municipalities and even banks often lack the technical knowledge to understand sustainability projects. If institutions struggle with this, imagine how difficult it is for end users, who find it even more challenging to understand what it means to adopt new solutions. They need someone who can structure projects clearly and ensure they are feasible; otherwise, innovation remains theoretical. (I4, Corporate Area Manager Bank 1)
In manufacturing, it is clear that older workers struggle with new technologies. If they cannot even handle basic digital tools, how can we expect the general population to embrace advanced, sustainable technologies at home? This generational divide needs to be addressed. (I2, HR Director of a furniture company)
End users find environmental sustainability harder to approach because it requires competencies they do not possess. In order to understand their environmental impact, identify improvement strategies and translate these into a project with associated costs, timelines and goals, they require the input of external experts. This is why adoption remains limited: a single consumer cannot do this alone. (I8, Marketing Corporate Manager Bank 2)
One challenge is ensuring that environmental sustainability is economically viable. When the adoption of green technologies increases short-term costs, many users become hesitant. While they may understand the long-term benefits, without a clear economic rationale it is difficult for them to engage with sustainable innovation. (I9, Corporate Area Manager, Bank 2)
Many of these relatively young companies pursue sustainability initiatives primarily to increase their visibility and market appeal, with the aim of being perceived as more competitive and recognised as a reference point by customers. Investments in employee well-being and improved working conditions often form part of this strategy. The direct impact of such initiatives on the final product is considered secondary; their value lies in how they are communicated and showcased. These efforts are usually displayed in the corporate social responsibility report, even for those firms that are not required to have such documents. (I9, Corporate Area Manager, Bank 2)
Theme: Need for strengthening the relationships between "traditional" SMEs and leading firms in sustainability
Many small and medium-sized companies were founded by one individual with a vision for the future. The entrepreneurial fabric is made up of excellent craftsmen with an average age of between 65 and 70. Yet these firms lack the structure to take the entrepreneur and their company into the future. These entrepreneurs do not see the value of sustainability and innovation. (I8, Marketing Corporate Manager, bank 2)
The arrival of major brands such as Louis Vuitton, Fendi and Gucci has increased competitive pressures on traditional SMEs, which have long served as training grounds for skilled labour. While larger, more structured firms can rely on advanced welfare and organisational practices, smaller firms are particularly vulnerable to losing key workers. This highlights the importance of strengthening the relationship between traditional SMEs and leading firms, particularly with regard to sustainability, in order to reduce structural imbalances and support the development of more stable and inclusive supply chains. (I9, Corporate Area Manager Bank 2)
What I have observed is a lack of knowledge. Engineers and designers from large companies should play a stronger role in informing entrepreneurs about the implications of their investments. (I2, HR Director of a furniture company)
Theme: Need of support by local stakeholders
ESG parameters are becoming increasingly important. We have already incorporated them into our company rating system, although current assessments are still quite basic. However, a major challenge remains: we need a concerted effort similar to Industry "4.0" to convert companies towards sustainability in terms of energy and the climate. . . . Italian companies suffer from low productivity and, above all, a limited willingness or ability to become sustainably oriented in the long term. Granting finance is increasingly linked to compliance with these rules. The rules of the game must be clear to all stakeholders. (I4, Corporate Area Manager, bank 1)
Sustainability today is a philosophy and a way of life. It is a necessity for companies and individuals alike to safeguard and improve the world. For an entrepreneur requesting a photovoltaic system or the technological modernisation of plant systems, the economic sustainability of such interventions must also be considered. A savvy entrepreneur knows that the bank wants its money back. Therefore, finding a bank that can assess the feasibility of investments is essential. (I11, Entrepreneur, plant contractor)
In my view, we need a comprehensive approach that starts with the mindset of an entrepreneur. Their consultant should be the first port of call. However, there is a void in this area, as most consultants are merely tax advisors who align themselves with the entrepreneur's wishes. (I8, Marketing Corporate Manager Bank 2)

(*continued*)

Table A2. Continued

Strengthening relationships within a broader ecosystem of actors – Illustrative quotes
In the past, we created a task force comprising experts in product development, certification, economics, finance and associations. Companies came and shared their needs. We need something like that again because companies cannot manage alone. Task forces of actors that adopt an interdisciplinary approach are needed. (I7, Managing Director certification 2)
We developed a catalogue of plug-in energy kits, but we had to source them from China because there are no local producers in Italy. The lack of responsiveness and industrial support at a local level restricts our ability to innovate. (I1, Managing director small home appliances)
Our main weakness is that we fail to operate as a system in our region. Bringing together our capabilities is the key challenge. Today, an individual company cannot succeed without an ecosystem of support. (I6, Innovation Manager Industry Association)
Even for a well-informed entrepreneur, it is difficult to understand what resources are available, how they can be used and what steps are required to implement them. Now imagine how much harder it is for those in disadvantaged areas with no infrastructure or nearby banks. A bank owned by a local foundation is good because part of its profits is reinvested in the local area. (I8, Marketing Corporate Manager, Bank 2)
The technologies are impressive, but how many companies can actually use them? How many can invest consistently enough to keep up? This is where other stakeholders come into play, such as industry associations, certification bodies and other companies. (I2, HR Director of a furniture company)
Theme: Need to bring firms and institutions closer together
Sending a small firm to the European negotiation table is difficult. It takes time to understand the context in which it operates. This means that such a firm has to stop doing its job and learn to do something completely different. Firms lack the time to do so. (I5, Managing Director certification 1)
The distance between the state and businesses is always huge. Those of us who pay millions in taxes sit at the back of the room while councillors and officials sit at the front. Institutions should start thinking more like entrepreneurs; otherwise, we cannot keep up. The same issue arises again: institutions must be run by competent people in the right roles. How can someone represent an industry if they don't understand its products, companies or sector? (I1, Managing director of small home appliances)
Municipalities and banks often lack the necessary knowledge. I have never been contacted by a bank to inform me of a NRRP call for photovoltaic systems, for example. Things only come together today when we manage to work as a team. (I11, Entrepreneur plant contractor)
There is a cultural gap and a mismatch that we have not yet managed to bridge. A team of people should work in the territory on a constant basis, connecting entrepreneurs with institutional opportunities. (I8, Marketing Corporate Manager Bank 2)
This is an issue for companies and industrial districts, as they are unable to find an effective form of representation. Business associations are also unable to provide it. (I3, Managing Director of a silver economy startup accelerator)

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Corresponding author
Andrea Perna can be contacted at: a.perna@staff.univpm.it