

Regional Sustainable Innovation via Trust and Preparedness

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ABSTRACT

European Union's Regional Innovation Valleys (RIVs) initiative provides a policy framework for challenge-driven, place-based innovation. At the same time, Artificial Intelligence (AI) is emerging as a strategic enabler of regional governance, climate action, and ecosystem coordination. However, the effective use of AI in regional innovation ecosystems depends not only on technical capacity but also on institutional preparedness and trust-based collaboration. This paper examines how hybrid trust, combining social and institutional trust, supports sustainable regional innovation and ethical AI integration. The study applies a qualitative case study approach drawing on regional development initiatives in Kanta-Häme, Finland, including eco-industrial parks, Evo research forests, the DEFINE defence and dual-use innovation network and startup ecosystem activities. The findings identify four interdependent pillars of regional preparedness: institutionalized political commitment, data standardization and governance, strategic finance and human capacity, and ecosystem-based implementation. The analysis shows that AI can strengthen regional sustainability and innovation performance when embedded in human-centric governance structures supported by participatory co-creation and credible institutions. Hybrid trust functions as a strategic lever by enabling cooperation across public, private, academic, and civic actors under conditions of uncertainty and transformation. The paper contributes to research on regional innovation ecosystems and Human Systems Integration by arguing that sustainable digital transformation is fundamentally socio-technical, relational, and place-based rather than purely technological.

Keywords: Regional innovation valleys, Hybrid trust, Preparedness, Artificial intelligence, Smart specialisation, Human systems integration

INTRODUCTION

European regional development policy is increasingly shaped by the combined demands of ecological transition, digital transformation, and long-term resilience. Regions are expected not only to reduce emissions and improve resource efficiency, but also to build innovation capacity capable of addressing complex societal challenges. Within this context, Smart Specialisation Strategies (S3) have become a central framework for aligning place-based strengths with future-oriented development priorities (Markkula and Kuhne, 2015; Asheim et al., 2019; Tukiainen et al., 2020). More recently, the European Union has introduced the Regional Innovation Valleys (RIVs) initiative to strengthen interregional cooperation and accelerate innovation

addressing societal missions such as climate adaptation, circular economy, technological transformation and security.

Yet innovation in regions does not emerge from technology or policy instruments alone. It is produced through interaction among municipalities, firms, research organizations, educational institutions, intermediaries, and citizens. Regional innovation ecosystems therefore depend on both formal governance capacity and the quality of relationships among actors (Ouden, 2012; Asheim et al., 2019; Salminen et al., 2022). This becomes especially important when regions seek to integrate Artificial Intelligence (AI) into strategy, monitoring, planning, and ecosystem coordination. AI can support regional sustainability efforts through predictive analytics, performance tracking, scenario modelling, matchmaking, and evidence-based decision support. However, it also introduces concerns related to transparency, accountability, data quality, algorithmic bias, and uneven access to capabilities (Bullock et al., 2024).

For this reason, preparedness is a critical issue. A region may aspire to use AI, but meaningful and ethical deployment requires institutional maturity, strategic coordination, reliable data, and adequate human capacity. Preparedness must therefore be understood not merely as technical readiness, but as a broader socio-institutional condition. Trust is central to this condition. Collaborative innovation depends on actors being willing to share information, align goals, take risks, and engage in long-term learning processes under uncertainty (Ouden, 2012; Senge, 1990).

This paper argues that hybrid trust, combining social and institutional trust, is a strategic precondition for sustainable regional innovation and responsible AI integration. Social trust supports co-creation, openness, and relational learning, while institutional trust provides confidence in governance structures, strategic continuity, and formal systems of coordination. Together, they enable regions to operationalize sustainability ambitions through AI-supported but human-centred innovation processes (Tukiainen et al., 2025).

The paper explores this argument through qualitative case evidence from Kanta-Häme, Finland. The region provides a relevant example because it combines strong bioeconomy and circular economy assets, active ecosystem development, and ongoing experimentation in both sustainability-oriented and dual-use innovation. The analysis focuses on four place-based contexts: eco-industrial parks, the Evo research forests, startup ecosystem initiatives and the DEFINE network from Riihimäki. Based on these cases, the paper identifies four pillars of regional preparedness that support sustainable innovation in Regional Innovation Valleys.

THEORETICAL FRAMEWORK

AI as an Enabler of Sustainable Regional Innovation Ecosystems

AI is increasingly recognized as a general-purpose technology with relevance far beyond industrial automation. In regional innovation ecosystems, AI can support sustainability transitions by enabling the analysis of large and heterogeneous datasets, improving forecasting and planning, and strengthening coordination across sectors. Its potential is particularly visible

in climate and security resilience, where AI can process information from satellites, sensors, inventories, land-use data, and historical records to improve monitoring, scenario building, and early warning functions (Bullock et al., 2024).

Within S3 and RIV contexts, AI can also support the entrepreneurial discovery process by helping identify emerging opportunities, map regional strengths, and reveal complementarities among actors and sectors. Such functions are valuable in challenge-driven innovation environments, where decision-makers must prioritize investments under uncertainty and connect local capabilities to broader transition agendas.

However, AI should not be conceptualized as an autonomous driver of sustainable transformation. Its effectiveness depends on the institutional context into which it is introduced. Regions require interoperable data, capable organizations, skilled intermediaries, and legitimate decision-making structures if AI is to create public value. Where these conditions are weak, AI may deepen fragmentation, obscure responsibility, or reproduce existing asymmetries instead of solving problems.

This perspective aligns with Human Systems Integration, which emphasizes that technological systems must be designed and implemented in ways that preserve human agency, support interpretive judgment, and align with social values. In regional development, AI should therefore be treated as an augmenting capability embedded within human-centred governance rather than as a substitute for deliberation or strategic leadership.

Trust as a Strategic Lever for Collaboration

Trust is a core enabling condition in innovation ecosystems because collaborative development requires actors to operate under uncertainty, interdependence, and partial information. Innovation often involves sharing knowledge, coordinating investments, and committing to actions whose outcomes cannot be fully predicted. In such settings, trust reduces perceived vulnerability and supports collective action (Blomqvist et al., 2026).

A hybrid trust perspective is particularly useful in regional innovation contexts. First, collaboration depends on both **social trust** and **institutional trust**. Social trust is rooted in interpersonal relations, repeated interaction, and boundary-spanning ties. Institutional trust is based on confidence in rules, governance structures, standards, contracts, and organizational continuity. Sustainable innovation ecosystems require both. Informal relations may initiate collaboration, but formal institutional arrangements help stabilize and scale it.

Second, trust contains both **cognitive** and **affective** dimensions. Cognition-based trust is grounded in assessments of competence, reliability, and expertise. Affect-based trust emerges from goodwill, shared identity, and relational commitment. The former is essential for evaluating technical and strategic capacity; the latter sustains creativity, resilience, and collaborative endurance in long-term transformation processes.

Third, it is useful to distinguish between **generalized trust** and **specific trusting behaviour**. A generalized orientation of trust supports openness to new partners and experimentation, while specific trust becomes visible when

actors decide to share resources or expose themselves to risk. In regional ecosystems, both forms matter because sustainability transitions require not only positive attitudes but concrete cooperative action.

Fourth, trust formation may rely on both **reputation** and **performance**. Reputation provides signals of credibility, yet many innovation partnerships must develop quickly. In such settings, “fast trust” may emerge from visible responsiveness, competence, and early action. This is especially relevant in newly formed ecosystem partnerships and interregional collaborations.

Trust is thus not a soft contextual variable but a strategic asset. It supports learning, lowers transaction costs, improves coordination, and strengthens willingness to innovate together. Importantly, trust is also central to responsible AI adoption. Actors are more likely to support AI-enabled governance when they trust both the people interpreting the systems and the institutions governing data and decision-making.

Preparedness and Smart Specialisation

Preparedness refers to a region’s ability to align strategy, governance, resources, and implementation capacity in response to emerging opportunities and challenges. In sustainability-oriented innovation, preparedness includes political commitment, organizational coordination, data readiness, skills, financing, and mechanisms for translating strategic intent into action.

Smart Specialisation provides a useful lens for understanding preparedness because it emphasizes place-based development rooted in distinctive regional strengths and entrepreneurial discovery (Markkula and Kuhne, 2015; Asheim et al., 2019). Rather than following generic development models, regions are encouraged to identify domains where local assets can support competitive and socially meaningful transformation (Takala et al., 2022). In Kanta-Häme, this includes bioeconomy, circular economy, sustainable industry, defence industry, dual-use technologies and applied experimentation.

Preparedness can also be interpreted through Appreciative Systems Theory, which highlights how change depends on what actors notice, value, and amplify within their environment (Vickers, 1968). This view shifts attention from deficits toward existing capabilities, learning processes, and institutional assets. Such an orientation is especially relevant for Regional Innovation Valleys, where success depends on mobilizing local strengths while connecting them to wider networks and societal missions.

Preparedness and trust are mutually reinforcing. Prepared institutions strengthen confidence in regional governance, while trust facilitates cooperation needed to build preparedness further. Together, they form a socio-institutional foundation for AI-enabled sustainable innovation.

METHODOLOGY

This study applies a qualitative case study approach informed by action research principles (Yin, 1989). The objective is to explore how trust, preparedness, and AI readiness interact in practice within a sustainability-oriented regional innovation ecosystem. A qualitative design is appropriate

because the phenomenon under examination is context-dependent, relational, and embedded in ongoing development processes.

The empirical material combines insights from four regional innovation development cases across Kanta-Häme, Finland. The material includes evidence from projects such as *Häme Goes into Ecosystems* and *Häme Regional Innovation Valley*, as well as strategic material prepared for Carbon Disclosure Project reporting and findings from participatory workshops (Takala et al., 2024; Takala et al., 2025). These sources were selected because they provide insight into regional sustainability governance, ecosystem coordination, experimentation, and capability-building.

The analysis proceeded through thematic interpretation. Attention was directed to situations in which collaboration depended on trust, where regional preparedness was strengthened or constrained, and where AI-related needs or opportunities emerged. The cases were grouped around four place-based innovation settings: eco-industrial parks, research forests, startup/co-creation initiatives and ecosystem development. Across these settings, four recurring dimensions of preparedness became visible: political and institutional commitment, data and governance infrastructure, finance and human capacity, and implementation through ecosystem-based action.

The study does not seek statistical generalization. Instead, it aims to provide analytical insights relevant to regions attempting to combine sustainability transitions, innovation ecosystem development, and responsible AI integration. The action research orientation strengthens practical relevance but also means that the analysis is interpretive and situated.

CASE EVIDENCE FROM KANTA-HÄME

Eco-Industrial Parks and SME Support

Kanta-Häme has developed several ecosystem platforms that support circular economy and industrial sustainability. Examples include Envitech in Forssa, RiiCycle in Riihimäki, and Industrial Park MORE in Hämeenlinna. These parks operate as hubs where material efficiency, energy optimization, and industrial symbiosis can be advanced through collaboration among co-located firms and supporting organizations.

Their significance lies not only in physical infrastructure but also in institutional coordination. For small and medium-sized enterprises, eco-industrial parks lower the threshold for engaging in sustainability innovation by providing access to networks, development support, and shared solutions. This is particularly important in circular economy transitions, where firms often need new partners, new information flows, and new forms of experimentation.

These settings illustrate how hybrid trust functions in practice. Social trust develops through repeated local interaction and ecosystem facilitation. Institutional trust is strengthened through governance, shared strategic direction, and visible support structures. Together, these conditions create an environment in which firms are more willing to exchange information, explore side-stream utilization, and adopt new digital tools. AI applications

related to material flow analysis, predictive optimization, and emissions monitoring are more likely to succeed in such contexts because the underlying relationships and governance arrangements already support collaboration.

Evo Research Forests as a Climate Adaptation Testbed

The Evo forests provide a strong example of place-based innovation connected to climate adaptation, forest resilience, and bioeconomy development. The area functions as a living laboratory in which ecological processes, forestry practices, carbon dynamics, and biodiversity can be observed over time. The SCAN FOREST infrastructure further strengthens this role by generating multi-temporal data on forest conditions and change.

This environment is highly relevant to AI-supported sustainability governance. Advanced analytics, remote sensing, drone-based observation, and predictive modelling can contribute to more informed understanding of forest dynamics and climate risks. At the same time, forest-related decisions are socially and politically sensitive. They involve competing values concerning conservation, livelihoods, carbon sequestration, and land use. As a result, technical capability alone is insufficient.

The Evo case highlights the importance of both cognitive and institutional trust. Actors must trust the quality of data and the competence of researchers, but they must also trust that data-driven tools are used transparently and in alignment with broader public goals. The case therefore demonstrates that AI readiness in environmental governance depends on long-term data infrastructures as well as credible and inclusive governance arrangements.

Startup Ecosystem and Participatory Co-Creation

Regional preparedness is also shaped by entrepreneurial culture, openness to experimentation, and participatory methods of innovation. In Kanta-Häme, initiatives such as the Linna Business Tournament, the FRUSH event, and the DEFINE ecosystem illustrate how ecosystem vitality is built through events, competitions, and collaborative spaces that connect startups, students, researchers, companies, municipalities, and investors.

Such initiatives help generate generalized trust by making interaction easier across institutional and sectoral boundaries. They also enable fast trust through action, since pitching, prototyping, and co-creation reveal commitment and competence quickly. The participatory AI supported workshops conducted at FRUSH events further illustrate how low-threshold co-creation methods can support stakeholder engagement and idea generation around regional well-being and development.

This dimension of the regional ecosystem is important because responsible digital and sustainability transitions require more than expert knowledge. They also require inclusion, imagination, and shared ownership. Participatory co-creation supports these goals by enabling diverse actors to contribute to strategic direction and innovation design. In this sense, startup ecosystem activity is not peripheral to preparedness; it is one of the mechanisms through which regions build adaptive capacity and social legitimacy.

DEFINE Network: Dual-Use Innovation, AI Capability, and Regional Resilience

A further example of place-based innovation in Kanta-Häme is the Defence Innovation Network Finland (DEFINE), an innovation ecosystem initiated by the City of Riihimäki. DEFINE brings together the Finnish Defence Forces, defence and security companies, educational institutions, research institutes, and other regional stakeholders in Riihimäki and the wider Kanta-Häme area. Its stated purpose is to accelerate innovation, competence creation, and business growth in defence, security, and dual-use technologies.

DEFINE demonstrates how regional preparedness can be built at the intersection of institutional coordination, talent development, and emerging AI-enabled innovation. The network's partnership model includes the City of Riihimäki, Häme University of Applied Sciences, the City of Hämeenlinna, Forssan Yrityskehitys Oy, Millog, and Sako Finland, while a significant share of its development funding in the early stage of the activities came through the European Regional Development Fund via Regional Council of Häme. This institutional structure illustrates how formal commitment and coordinated investment can create an enabling environment for long-term capability formation.

DEFINE includes a three-month accelerator designed to help defence, security, and dual-use startups transform technologies into scalable businesses with the support of mentors, experts, and industry actors. The accelerator strengthens the social side of hybrid trust through repeated interaction, mentoring, prototyping, and performance-based learning. These mechanisms are particularly important in fields where innovation requires rapid capability validation and strong confidence in partner competence.

The network enhances preparedness and demonstrates that regional innovation valleys are not limited to environmental or circular-economy domains. They may also support resilient capability formation in critical and dual-use technologies. In January 2026, DEFINE announced a nationwide expansion supported by SITRA. In that expansion, Riihimäki was presented as the main hub for cooperation with the Finnish Defence Forces, with technological spearheads in artificial intelligence and autonomous solutions. At the same time, Häme University of Applied Sciences was identified as investing in local AI solutions and training for defence-sector needs, while Hämeenlinna contributed a focus on security of supply and resilience and Forssa on ESG competence.

As a Kanta-Häme case, DEFINE complements the eco-industrial park, forest, and startup examples by demonstrating that preparedness for sustainable regional innovation can also include resilient security-oriented innovation capacity. The case reinforces the main argument that AI readiness depends not only on technical assets, but also on trusted institutional frameworks, regional coordination, talent ecosystems, and cross-sector collaboration.

RESULTS: FOUR PILLARS OF REGIONAL PREPAREDNESS

The analysis identified four interdependent pillars that support ethical AI integration and sustainable innovation in Regional Innovation Valleys.

Institutionalized Political Commitment

The first pillar is long-term political and institutional commitment. Sustainability ambitions become operational only when they are embedded in formal strategies, planning frameworks, and governance structures. Carbon neutrality targets, circular economy priorities, and climate resilience goals must be institutionalized rather than treated as temporary project themes. Such formalization strengthens continuity, clarifies priorities, and signals seriousness to ecosystem actors.

This pillar also supports AI integration. Where strategic goals are explicit and stable, AI tools can be aligned with clearly defined public purposes rather than adopted in an ad hoc manner. Institutional commitment therefore strengthens both preparedness and trust.

Data Standardization and Governance

The second pillar is data standardization and transparent governance. AI systems require reliable, accessible, and interoperable data. For regions, this includes socio-economic evidence, material flow data, land-use information, biodiversity indicators, and emissions data. Clean and well-governed datasets are not only technical resources; they are prerequisites for credible and accountable AI use.

The cases suggest that data readiness is often one of the most critical bottlenecks in regional digital transformation. Centralized reporting structures and transparent management systems increase both analytical capacity and stakeholder confidence. In this sense, data governance is also a trust-building mechanism.

Strategic Finance and Human Capacity

The third pillar is the alignment of finance and skills with transformation goals. Regions require investment channels that support green innovation, experimentation, startup growth, and ecosystem development. Equally important is the cultivation of talent ecosystems that combine sustainability expertise, systems thinking, facilitation capability, and digital competence.

Human capacity is particularly important in AI-supported governance because interpreting model outputs, questioning assumptions, and making ethically informed decisions remain human responsibilities. Preparedness therefore depends not only on technology acquisition but on the region's ability to mobilize knowledgeable actors across organizational boundaries.

Ecosystem-Based Implementation

The fourth pillar is implementation through place-based ecosystems and practical experimentation. Preparedness becomes visible when strategy is translated into action through industrial symbiosis, climate adaptation pilots, forest testbeds, participatory innovation formats, and other concrete initiatives. Ecosystem-based implementation strengthens trust by demonstrating capability and producing visible outcomes.

This pillar also supports learning. Through experimentation, actors refine governance arrangements, improve data practices, and build stronger relationships. In this way, implementation is both an outcome of preparedness and a mechanism for deepening it.

DISCUSSION

The findings suggest that sustainable regional innovation depends on the interaction of technological capability, institutional quality, and collaborative trust. AI can improve regional intelligence and support more effective sustainability action, but its contribution is contingent on preparedness. Where regions lack coherent governance, standardized data, or trust-based collaboration, AI may remain symbolic, fragmented, or ethically problematic.

The concept of hybrid trust offers an important contribution to regional innovation theory. It helps explain why some ecosystems can coordinate across sectors and scales while others struggle despite similar formal resources. Social trust facilitates openness, co-creation, and informal knowledge exchange, whereas institutional trust provides legitimacy, continuity, and procedural assurance. Both are necessary in Regional Innovation Valleys, where mission-oriented collaboration must extend across organizations and often across regions and countries.

The analysis also raises ethical concerns that deserve further attention. First, AI may widen the digital divide if capabilities and access remain concentrated in stronger organizations or urban centres. Second, algorithmic bias may distort priorities when local data are incomplete or unrepresentative. Third, black-box systems may undermine accountability if regional stakeholders cannot understand how outputs are produced. These risks reinforce the importance of Human Systems Integration. AI should support, not replace, contextual interpretation, democratic oversight, and value-based judgment.

For policy and practice, the results imply that RIV development should invest not only in innovation infrastructure and digital tools but also in governance capability, trust-building, participatory methods, and regional learning processes. The strength of a regional innovation valley lies not simply in the presence of technology, but in its ability to embed technology in legitimate and human-centred collaboration.

CONCLUSION

This paper examined how AI, hybrid trust, and preparedness interact in sustainable regional innovation. Using qualitative case evidence from Kanta-Häme, Finland, it argued that AI can strengthen Regional Innovation Valleys only when supported by socio-institutional conditions that enable trustworthy, participatory, and strategically coherent collaboration.

Four pillars of preparedness were identified: institutionalized political commitment, data standardization and governance, strategic finance and human capacity, and ecosystem-based implementation. These pillars form a practical framework for regions seeking to align digital transformation with sustainability goals under S3 and RIV agendas.

The main conclusion is that sustainable regional innovation is not achieved through technology alone. It emerges when AI capabilities are anchored in hybrid trust, place-based strengths, and human-centric governance. For Regional Innovation Valleys, this means that long-term competitiveness and resilience depend as much on relational and institutional quality as on technological sophistication.

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