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Transition Intelligence Lab

Activities, Methodological Framework, and Research Directions
(2023–2025)

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1 Introduction

Between 2023 and 2025, the Transition Intelligence Lab (TIL) at the University of Brescia organized a structured set of initiatives devoted to understanding how major societal, technological, economic, cultural, and environmental changes unfold and interact. Seminars, public events, and interdisciplinary exchanges were designed not as isolated moments, but as parts of a coherent trajectory aimed at constructing a shared understanding of transitions as complex and multifaceted processes.

In this perspective, transitions are not interpreted merely as sectoral shifts or incremental adjustments, but as transformations that involve multiple domains and governance levels at the same time. They raise questions about how societies reorganize around new technological paradigms, how institutions adapt to long-term pressures, how economic structures and cultural narratives evolve, and how environmental constraints shape and are shaped by human action.

The present report reflects on this period of activity and its outcomes. It offers an overview of the Lab's institutional and scientific identity, a reconstruction of the seminars and events held between 2024 and 2025, a systematization of the methodological paradigm that has emerged from these encounters, and an outline of strategic research priorities for the next years.

2 The Transition Intelligence Lab

TIL is an interdisciplinary research laboratory established on December 19, 2023 within the University of Brescia. It is hosted by the Department of Mechanical and Industrial Engineering but is explicitly designed as a space that bridges disciplinary boundaries and engages with multiple faculties and external actors. TIL defines transition intelligence as the ability to collect, organize, interpret, and use data and knowledge about transitions in ways that support research agenda setting in both academic and policy-oriented contexts, as well as policy development, strategic decision-making, and societal resilience. Transitions here include technological innovations, economic restructurings, socio-cultural transformations, environmental changes, and institutional reconfigurations, all of which are understood as intertwined processes rather than isolated phenomena. From its inception, the Lab has been guided by three closely related principles: a systemic perspective, a strong commitment to interdisciplinarity, and a focus on public engagement and co-creation.

2.1 Systemic Perspective

The systemic perspective adopted by TIL starts from the idea that transitions unfold within and across complex systems. Technological change, for example, cannot be understood without considering its linkages to regulatory frameworks, market structures, social practices, cultural expectations, and environmental constraints. Similarly, institutional reforms are shaped by path dependencies, historical legacies, and feedback loops that cut across sectors and scales. This approach draws on systems engineering, socio-technical transitions theory, and complexity science. These fields converge in emphasizing that transitions are characterized by multi-level

interactions among actors, technologies, infrastructures, norms, and ecological conditions. Understanding them requires attention to emergent properties, nonlinear dynamics, and the possibility of tipping points, as well as to the role of adaptive behavior and learning. Within this systemic horizon, the Lab seeks to go beyond linear cause–effect narratives and to foreground questions about interdependencies, uncertainty, and long-term trajectories.

2.2 Interdisciplinarity

Interdisciplinarity is not conceived at TIL as a generic aspiration, but as a methodological necessity. The impacts and opportunities associated with transitions cut across technical, economic, legal, social, cultural, and ethical dimensions. No single discipline is sufficient to capture their full complexity. For this reason, the Lab actively promotes collaboration among scholars of engineering, economics, management, law, philosophy, social sciences, and environmental studies. This collaboration involves joint seminar design, co-authored research, and the construction of shared conceptual and methodological tools. The aim is not to dissolve disciplinary identities, but to create fertile interfaces where methods, vocabularies, and empirical insights can be translated and recombined. This interdisciplinary orientation has been concretely embodied in the seminar series, which has regularly brought together speakers and participants from different backgrounds around shared questions on transitions, governance, ethics, and resilience.

2.3 Public Engagement and Co-creation

A further defining element of TIL is its attention to public engagement and co-creation. The Lab does not confine itself to academic dialogue, but seeks to build bridges with policymakers, businesses, civil society organizations, and citizens. Public events, participation in broader initiatives such as the European Researchers' Night, and collaborations with cultural institutions are not ancillary activities. They are integral to the Lab's mission as they contribute to grounding analytical work in real-world concerns, identifying emerging issues, and opening spaces for deliberation around transition challenges. This engagement dimension also underpins the Lab's interest in governance, ethics, communication, and legitimacy. The very notion of transition intelligence implies a concern for how knowledge is produced, shared, and used in collective decision-making, and for how responsibilities and benefits are distributed across actors and generations.

3 TIL Events in 2024–2025

Between February 2024 and September 2025, the Transition Intelligence Lab organized a structured series of seminars and public events aimed at deepening the understanding of transitions across social, economic, technological, cultural, and environmental domains. Each event brought together scholars and practitioners from different disciplines, reinforcing the Lab's commitment to interdisciplinary and scientifically grounded dialogue.

February 12, 2024 — Kickoff Meeting: Launch of the Lab's Activities

DIMI Meeting Room, University of Brescia

Speakers: Prof. Massimiliano Granieri and Marialuisa Volta, University of Brescia

The Kickoff Meeting formally launched the Lab's operations. The coordinators, Prof. Massimiliano Granieri and Prof. Marialuisa Volta, presented the mission, governance structure, research objectives, and planned activities of TIL. The meeting served to position the Lab within the University and to outline its ambition to become a reference point for transition-related research and public engagement.

March 25, 2024 — Language and Transitions: Understanding Change Through Communication

Putti Room, Department of Law, University of Brescia

Speaker: Prof. Valerio Villa, University of Brescia

In this seminar, Professor Villa examined how language can be understood both as a driver and an indicator of societal transitions. Focusing on transformations in vocabulary, discourse, and framing, he showed how linguistic changes shape public perceptions, institutional behavior, and policy responses. The discussion highlighted how communication can enable or constrain systemic change by legitimizing certain narratives, making particular problems visible while marginalizing others, and influencing what is perceived as possible, desirable, or inevitable.

April 29, 2024 — Transitions in Agriculture: Challenges and Opportunities

DEM Meeting Room, Department of Economics and Management, University of Brescia

Speaker: Prof. Paolo Ajmone Marsan (Università Cattolica del Sacro Cuore)

Professor Ajmone Marsan focused on the profound transformations affecting agricultural systems in response to climate change, technological innovation, and socio-economic restructuring. The seminar addressed issues such as genetic resource management, the resilience of agricultural ecosystems, rural development, and sustainability in food production. Attention was paid to how agricultural transitions intersect with questions of biodiversity, food security, and territorial cohesion.

May 27, 2024 — Bioethics and Responsibility in Transitions

Room S, Faculty of Medicine, University of Brescia

Speaker: Prof. Adelaide Conti, University of Brescia

In this seminar, Professor Conti explored the ethical dimensions inherent in transitions involving science, technology, and society. She discussed moral responsibility, justice, and sustainability as crucial criteria for evaluating transition pathways and decision-making processes. The session offered frameworks for guiding collective and institutional choices during periods of rapid transformation, emphasizing the need for ethical reflection not as an ex post evaluation, but as an integral component of transition governance.

June 24, 2024 — Exploring the Energy Transition: Perspectives from Research

DIMI, University of Brescia

Speaker: Prof. Sergio Vergalli, University of Brescia

Professor Vergalli provided an interdisciplinary overview of the energy transition, bringing together economic, technological, social, and environmental perspectives. He discussed systemic interdependencies in energy systems, trade-offs between growth, decarbonization, and social equity, and the role of policy instruments in steering transitions. The seminar reinforced the relevance of system-wide analysis, scenario-building, and long-term planning in the domain of energy.

July 29, 2024 — Understanding Governance Through Transitions

DIMI meeting room, University of Brescia

Speaker: Prof. Leonida Tedoldi, University of Bergamo

Professor Tedoldi examined governance transitions through a historical and institutional lens. He argued that changes in governance arrangements often emerge through incremental adaptation rather than abrupt rupture, and that they are shaped by long-term socio-political processes and constraints. The seminar explored how institutional continuity and innovation interact, and how historical trajectories condition the possibilities for contemporary governance reform.

October 1, 2024 — Mathematical Models to Navigate Transitions

DIMI meeting room, University of Brescia

Speaker: Prof. Marialuisa Volta, University of Brescia

This seminar focused on the role of analytical and mathematical modeling in transition governance. Professor Volta illustrated how models can simulate system dynamics, construct future scenarios, identify critical intervention points, and support evidence-based decision-making. She emphasized the need to combine quantitative analysis with qualitative insights and stakeholder knowledge, especially when addressing problems characterized by complexity, uncertainty, and multiple, sometimes conflicting, objectives.

October 29, 2024 — Transitions: Understanding and Managing Change

MITA Cultural Center, Brescia

Speakers: Prof. Massimiliano Granieri, Prof. Giovanni Valagussa, Prof. Mariasole Bannò, Prof. Sergio Vergalli, Prof. Marialuisa Volta

This public, multidisciplinary event brought together a group of scholars including Prof. Massimiliano Granieri, Prof. Giovanni Valagussa, Prof. Mariasole Bannò, Prof. Sergio Vergalli, and Prof. Marialuisa Volta. The event explored transitions across domains such as culture, management, energy, and analytical methods. It highlighted the need for interdisciplinary frameworks to grasp complex transitions and concluded with a roundtable discussion on shared methodologies for understanding and managing change in a coherent way.

November 5, 2024 — From Citizens to Customers: Rethinking the Human Model in Contemporary Governance

DIMI meeting room, University of Brescia

Speaker: Prof. Alberto Sciumè, University of Brescia

Professor Sciumè examined the evolving conceptualization of individuals within contemporary governance systems. He traced the shift from a civic-based identity, associated with the notion of the citizen, to a market-based one, associated with the figure of the customer, especially in the context of digital and algorithmic governance. The seminar discussed implications for democracy, participation, rights, and accountability in institutions increasingly shaped by data-driven logics.

April 3, 2025 — Acting, Learning, and Adapting: Navigating Complexity with Resilience

Apollo Room, Rectorate, University of Brescia

Speaker: Prof. Alberto F. De Toni, University of Udine

In this lecture, Professor De Toni introduced principles from complexity science as applied to organizations and governance systems. He emphasized acting, learning, and adapting as essential strategies for navigating contexts characterized by volatility, uncertainty, and interdependence. The seminar presented resilience-oriented frameworks for public and private organizations and highlighted the importance of developing adaptive capacities rather than relying solely on static planning.

May 29, 2025 — Just Transition and Impact Measurement: An (Un)sustainable Bluff or a Paradigm Shift in Economic Action?

Apollo Room, Rectorate, University of Brescia

Speakers: Prof. Alberto Sciumè (University of Brescia), Prof. Giulio Fasi (European Commission & Sciences Po), Dr. Lucia Alessi (European Commission), Prof. Luigi Corvo (Open Impact & Università di Milano-Bicocca); roundtable moderated by Prof. Massimiliano Granieri (University of Brescia) with Prof. Bani (University of Bergamo), Prof. Mariasole Bannò (University of Brescia), Dr. Carmen Di Santo (Lombardy Energy Cleantech Cluster), Dr. Alberto Calvo (MITO Technology), Dr. Alberto Perani (Consiglio Nazionale Dottori Commercialisti).

Co-organized by the Transition Intelligence Lab and the Centre for European Affairs (CREAF)

The seminar examined the role of impact measurement and just transition within European sustainability policies, questioning whether current approaches signal a substantive transformation of economic practices or risk remaining largely rhetorical. Discussions focused on sustainability as a regulatory objective for financial markets and on the tension between economic growth and environmental and social goals. Professor Sciumè highlighted the persistent conflict between growth-oriented models and sustainability commitments, while Professor Fasi emphasized how preferences for maintaining the status quo delay necessary structural change and reinforce

technocratic governance. Dr. Lucia Alessi illustrated the European regulatory framework for sustainable finance, and Professor Corvo critically revisited the Weberian conception of the firm, stressing the relevance of non-financial reporting for measuring social impact. The concluding roundtable addressed impact assessment, governance, and regulatory challenges from legal, social, entrepreneurial, financial, and accounting perspectives .

September 26, 2025 — Clear Science, Dark Science: Awareness as the Key to the Future of Research

Santa Giulia Museum, Brescia

Speaker: Prof. Gianfranco Pacchioni, University of Milan, National Academy of the Lincei, Interviewed by Prof. Massimiliano Granieri, University of Brescia

Organized as part of the European Researchers' Night, this public dialogue addressed the tension between "clear" science, understood as transparent and publicly accessible research, and "dark" science, referring to private, proprietary, or confidential knowledge production. The discussion raised ethical and societal questions concerning the governance of scientific knowledge, the responsibilities of research communities, and the implications of different regimes of openness and secrecy in a rapidly changing innovation ecosystem.

4 An Analytical Paradigm for Transition Research

The methodological paradigm developed within the Transition Intelligence Lab draws on a set of theoretical foundations that interpret transitions as dynamic, multi-dimensional processes. These foundations include **complexity science**, **socio-technical transitions theory**, **resilience theory**, and **Transition Management**, which together conceptualise transitions as long-term transformations shaped by interactions among technologies, institutions, actors, and cultural frameworks.

According to complexity science, transitions take place within *complex adaptive systems* characterised by non-linearity, feedback loops, and emergent behaviour (Holland, 2006). This perspective underlines that systemic change cannot be reduced to linear cause–effect dynamics, as outcomes emerge from the interplay of interdependent components. Complexity thinking also highlights the roles of learning, adaptation, and self-organisation, which are essential for interpreting how transition trajectories unfold.

A complementary lens is provided by socio-technical transitions theory, in particular the *Multi-Level Perspective (MLP)* (Geels, 2002; Geels & Schot, 2007). The MLP describes transitions as interactions between emerging innovations, stabilised socio-technical regimes, and wider landscape pressures such as climate change or demographic shifts. This framework clarifies how structural change materialises when niche innovations become aligned with shifting landscape conditions and begin to challenge incumbent regimes.

Resilience theory contributes an additional emphasis on the ability of systems to reorganise while retaining core functions (Folke, 2006). It focuses on adaptive

capacity, learning, and flexibility in contexts characterised by uncertainty and disturbance - elements that are crucial during transition phases.

Finally, Transition Management offers a governance-oriented interpretation, viewing transitions as co-evolutionary processes involving aligned shifts in technologies, values, and institutional arrangements (Rotmans, Kemp & van Asselt, 2001; Loorbach, 2010). Transition Management stresses long-term orientation, experimentation, and participatory processes as foundations for shaping transition pathways.

Together, these theories provide the conceptual background for the TIL's integrated approach.

4.1 Transitions as Complex Adaptive Processes Enabled by Technology, Values, and Institutions

Transitions emerge from the interaction between technological innovation, institutional structures, and social values. Complexity theory (Holland, 2006) highlights that such interactions generate nonlinear and often unexpected dynamics. At the same time, the Multi-Level Perspective (Geels, 2002) explains how innovations developed in protected niches can gain relevance when broader landscape pressures destabilise established regimes.

Quantitative analytical tools employed by the TIL support the exploration of these interactions. System dynamics modelling enables the study of feedback loops, thresholds, and long-term scenarios (Hoffmann et al., 2025). Agent-based models simulate heterogeneous behaviours and micro-macro interactions, while network analysis highlights structural dependencies and vulnerabilities (Cincotti et al., 2022). Integrated Assessment Models provide a framework for evaluating alternative transition pathways under conditions of uncertainty (Wilson, 2021).

These approaches were central to several TIL seminars. Volta (2024) illustrated how mathematical models guide decision-making in complex systems. Vergalli (2024) examined the interplay between technological, economic, and environmental factors in energy transitions. Ajmone Marsan (2024) demonstrated how agricultural transitions result from intertwined bio-physical and socio-economic forces. De Toni (2025) emphasised adaptive strategies derived from complexity science.

4.2 Qualitative and Interpretive Frameworks to Understand Values, Narratives, and Norms

Transitions also involve shifts in cultural meanings, ethical principles, and institutional logics. Sustainability transitions research highlights the importance of interpretive processes in shaping strategies and societal acceptance (Markard, Raven & Truffer, 2012). Transition Management reinforces this by emphasising shared visions, learning processes, and deliberative governance (Loorbach, 2010).

To address these dimensions, the TIL employs qualitative methods such as discourse analysis, institutional analysis, and ethical inquiry. These methods draw on established research demonstrating that actors' interpretations and narratives influence transition pathways and the legitimacy of decisions (Smith, Stirling & Berkhout, 2005).

TIL events offered applied insights into these interpretive dynamics. Villa (2024) discussed how language frames societal perceptions of change. Conti (2024) addressed ethical issues such as responsibility and justice in transitions. Tedoldi (2024) examined the evolution of governance traditions, while Sciumè (2024) analysed changing conceptions of the individual in governance. Pacchioni (2025) explored transparency and trust in scientific knowledge production.

4.3 An Integrated Paradigm: Aligning Technologies, Values, and Institutions

The Transition Intelligence Lab adopts an integrated paradigm that brings together structural system analysis and interpretive inquiry. Complexity theory helps describe how system behaviour emerges; the Multi-Level Perspective situates transitions within evolving socio-technical structures; resilience theory introduces adaptive capacity; and Transition Management provides a framework for coordinated action across actors and institutions.

Within this paradigm, transitions are understood to occur when technological innovation, value change, and institutional adaptation evolve in mutually supportive ways. This co-evolutionary understanding underpins the development of decision-support tools, scenario analyses, and governance strategies that reflect both systemic constraints and societal aspirations.

The multidisciplinary event of October 29, 2024 exemplified this perspective, showing how contributions from engineering, economics, governance, culture, and ethics must converge for transitions to be interpreted and governed effectively. Through such integration, the TIL develops analytical outputs that are both scientifically rigorous and socially grounded, supporting informed decision-making in complex transition contexts.

5 Strategic Research Directions

The strategic research agenda of the Transition Intelligence Lab builds on the methodological paradigm presented in Chapter 4 and operationalises it into three coherent lines of research. Each direction reflects a distinct dimension of transition analysis. Together, such three directions position the TIL as a hub for integrated transition research, capable of informing policy and practice through rigorous, interdisciplinary, and context-sensitive analysis.

The first direction strengthens systemic transition modelling as a practical decision-support approach. This line focuses on enhancing the usability, transparency, and relevance of modelling tools for policymakers, promoting participatory integration and iterative learning. The aim is to translate complex system diagnostics into actionable insights that support strategic planning in uncertain environments.

The second direction addresses governance, institutional evolution, and resilience. The research concentrates on understanding how institutions coordinate across scales, build adaptive capacity, and redesign organisational routines in response to systemic pressures. This direction supports the development of diagnostic tools and empirical analyses that help institutions navigate long-term change.

The third research direction concerns ethical, cultural, and narrative dimensions of transitions. It explores how societies interpret change, negotiate meanings, and articulate shared visions of desirable futures. This line focuses on the implications of ethical principles, communication strategies, and collective narratives for institutional legitimacy and the social feasibility of transition pathways.

6 Conclusion

Over the period 2023–2025, the Transition Intelligence Lab has established a coherent scientific identity rooted in complexity, interdisciplinarity, and methodological integration. The seminars and public events organized from 2024 to 2025 have played a crucial role in refining this vision, revealing the need to combine systemic and quantitative analysis with qualitative, ethical, and institutional perspectives. On this basis, the Lab has articulated a structured methodological paradigm for transition research and has identified three strategic research directions that will guide its future activities: systemic transition modeling and decision-support tools, governance and resilience in complex systems, and the ethical, cultural, and narrative dimensions of transitions. Through this work, the Transition Intelligence Lab aims to serve as a hub for transition intelligence, supporting institutions and society in navigating systemic change through analytically rigorous, context-aware, and socially informed approaches, contributing to the design of more just and resilient pathways of transformation.

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