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Exploring ‘Trust’ among REAP Stakeholders in Innovation Ecosystems:

An Introductory Study using ‘Relational Contract’ Theory

Working Paper 1 – Version 1.0

Karen Luu, EMBA 24’

MIT Sloan School of Management

Supervised by: Dr. Phil Budden, Senior Lecturer

MIT Sloan School of Management

SD Model Contributor, Mar-Sept 2024: Cynthia Garde, EMBA 14’

MIT Sloan School of Management

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Exploring 'Trust' among REAP Stakeholders in Innovation Ecosystems:
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Introduction

Trust is a cornerstone of thriving ecosystems of 'innovation-driven enterprises' (IDEs). In its absence, the cooperation and reciprocity required among stakeholders are difficult to achieve, constraining both growth and long-term success. This working paper adopts a multi-disciplinary perspective, drawing on concepts and insights from various fields to examine the dynamics of regional innovation ecosystems. In particular, the study focuses on trust-building mechanisms and their relationship with relational contracts, or informal agreements, as important elements shaping ecosystem development.

The study is grounded in extensive research on innovation, namely the seminal work by Profs Scott Stern and Fiona Murray et al., titled "Accelerating Innovation Ecosystems: The Promise and Challenges of Regional Innovation Engines."[1] It also draws on case studies, particularly from the *MIT Regional Entrepreneurship Acceleration Program (REAP)* and on teaching in the National Science Foundation's *Regional Innovation Engines (RIE)* initiative, both of which are grounded in academic research.[2] Additionally, this paper incorporates MIT's multi-stakeholder framework for innovation ecosystems, taught by Dr. Phil Budden in his REAP and REAL[3] courses.

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[1] Scott Stern, Fiona Murray, et al., "Accelerating Innovation Ecosystems: The Promise and Challenges of Regional Innovation Engines," *Entrepreneurship and Innovation Policy and the Economy* 3 (2024), https://doi.org/10.3386/w31541

[2] MIT, *Regional Entrepreneurship Acceleration Program (REAP)*, https://reap.mit.edu/; National Science Foundation (NSF), "Regional Innovation Engines (RIE)," https://www.nsf.gov/funding/initiatives/regional-innovation-engines

[3] Phil Budden, *Innovation Ecosystems for Regional Entrepreneurship*, iEco4REAL 15.364 (course material, Massachusetts Institute of Technology, 2024.

Complementing these applied frameworks, this Paper also draws perspectives from MIT's Management School to provide greater theoretical depth to the analysis of innovation ecosystems. In particular, it integrates Prof. Robert Gibbons and Rebecca Henderson's work on 'relational contracts,' Prof. John Sterman's expertise in 'system dynamics,' and Prof. Roberto Rigobon's lectures on economics and trust. Together, these perspectives provide a comprehensive view of the factors that shape the success or failure of innovation ecosystems, with specific attention to how trust-building interacts with relational contracts.

Methodology

This study applies two different yet complementary frameworks to generate insights and recommendations: *iEcosystems* and *System Dynamics*

1. **Innovation-Driven Entrepreneurship Ecosystems (iEcosystems) Framework**

   Developed at the Massachusetts Institute of Technology (MIT), this framework focuses on assessing *innovation-driven entrepreneurship ecosystems (**iEcosystems**)*—"geographically bounded places where **innovation-driven enterprises (IDEs)** can flourish."[4] IDEs are ventures that combine innovation with high-growth potential, distinguishing them from traditional small or medium-sized enterprises. MIT's approach emphasizes the powerful combination of innovation and entrepreneurship, using a set of globally available metrics to evaluate the conditions that enable IDEs to emerge, scale, and generate impact.

   Within this approach, the **MIT REAP Stakeholder Model** brings together leaders from *government, corporates, universities, risk capital,* and *entrepreneurs* to create a comprehensive view of a region's innovation ecosystem. Each group

[4] Phil Budden and Fiona Murray, Assessing Innovation Ecosystems: Enhancing Innovation and Growth through Systematic Ecosystem Assessment, MIT Regional Entrepreneurship Acceleration Program, accessed March 2, 2024, https://reap.mit.edu/assets/Assessing-iEcosystems.pdf.

plays a distinct but interdependent role: government shapes policy and infrastructure, corporates provide resources and market access, universities generate research and talent, investors supply funding and expertise, and entrepreneurs drive innovation on the ground. By combining these perspectives, REAP engages strategies that are both evidence-based and grounded in real-world needs.

As the diagram below illustrates, the model's strength comes from balance. Each stakeholder contributes a vital piece, and it is through their collective efforts that a resilient and innovative ecosystem can take shape.

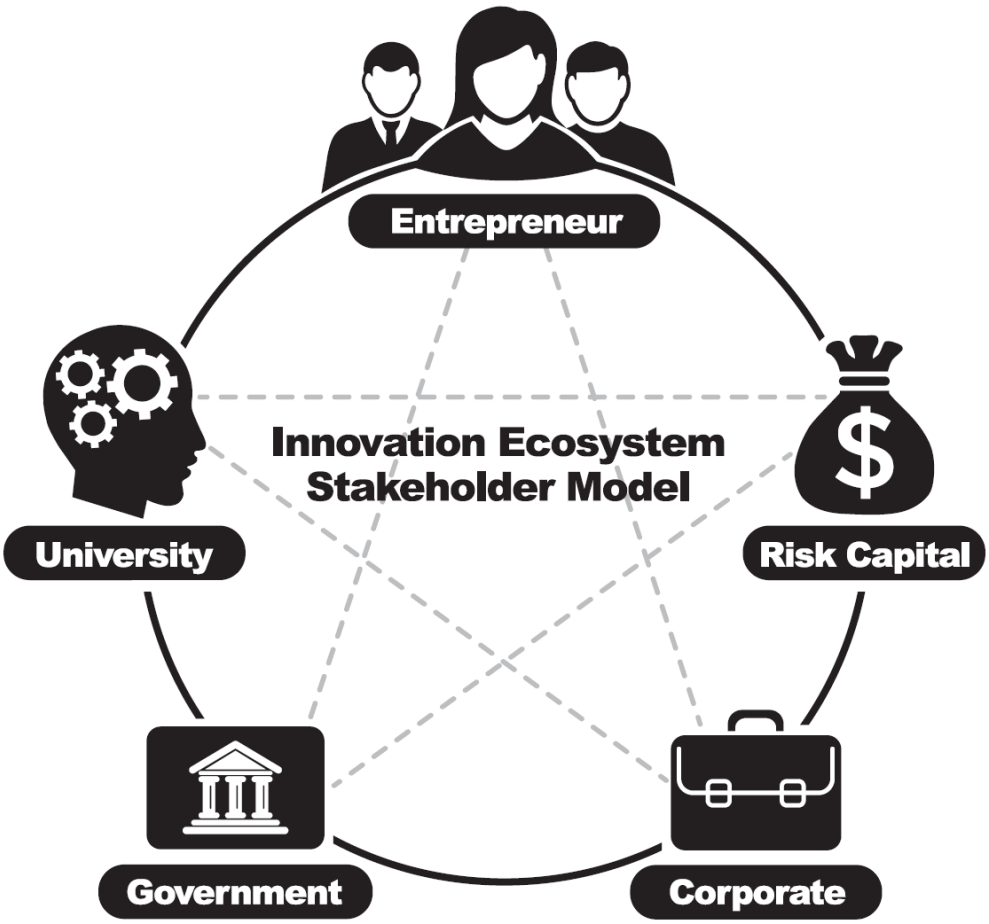


Figure 1.0 – REAP Stakeholder Model

2. System Dynamics Framework

Coupled with the framework to assess iEcosystems, **system dynamics** offers a powerful method for understanding the behavior of complex systems over time, accounting for feedback loops, delays, and non-linear interactions that shape their evolution. It enables us to understand and predict system behavior more effectively. “System dynamics is a method to enhance learning in complex systems…to help us learn about dynamic complexity, understand the sources of policy resistance, and design more effective policies.”[5]

The field of system dynamics provides unique perspectives through an interdisciplinary framework of viewing the world and its constituents as systems and independent relationships through causality and feedback structures. “All dynamics arise from the interaction of just two types of feedback loops, positive (or self-reinforcing) and negative (or self-correcting) loops.”[6] Positive loops amplify changes, leading to growth that can be either virtuous, such as an increasing number of startups maturing each year, or vicious, such as initiatives causing overuse of resources and increased degradation. In contrast, negative loops counteract changes, thereby stabilizing the system.

The methodology involves developing an understanding of the problem and analyzing case studies using causal loop diagramming (CLD). This includes forming a hypothesis and creating models through continuous inspection and simulation, based on mathematical and control system logical structures.

[5] John D. Sterman, Business Dynamics: Systems Thinking and Modeling for a Complex World (Boston: Irwin McGraw-Hill, 2000), chap 1.
[6] Sterman, "Business Dynamics," chap 1.

Approach

iEcosystems are inherently complex, involving diverse stakeholders, dynamic interactions, and limited data that make it difficult to capture differing perspectives, particularly around trust. To address these challenges, this introductory mechanical study adopts a multi-disciplinary approach that is grounded in system dynamics. We begin with a model of ecosystem behavior based on the REAP Madrid Case Study, followed by two additional models that explore trust and its dynamic interaction with relational contracts. This approach allows us to map relationships and feedback loops, highlight how actions and disruptions can shift outcomes, and reveal the causal mechanisms that shape ecosystem performance and inform strategies for innovation and growth.

Defining and Modeling Trust

Challenges in Studying Trust

Studying institutional trust within the iEcosystem presents significant challenges due to its subjective nature. Trust is inherently based on personal beliefs and qualitative factors, making it difficult to quantify with clear, quantitative metrics.[7] The concept of trust is context-based, and its multifaceted dynamic nature makes trust modeling complex and challenging to measure for the following reasons:

- **Dynamic Nature:** Trust is not static and evolves over time based on experiences and interactions. Longitudinal studies are necessary to understand how trust changes over time, but these studies are resource-intensive and complex to administer.

[7] OECD, OECD Guidelines on Measuring Trust, OECD Publishing, Paris, 2017, https://read.oecd-ilibrary.org/governance/oecd-guidelines-on-measuring-trust_9789264278219-en#page1

- **Cultural Variability:** Different cultures interpret trust differently, influenced by mental models and personal experiences.

- **Cumulative Nature:** Trust is built or eroded incrementally; some actions may reduce trust slightly, while others can destroy it completely.

- **Behavioral Inconsistency:** Human behavior can be inconsistent and unpredictable, complicating trust modeling.

- **Limited Measurement Methods and Tools:** Traditional methods of measuring trust, such as surveys and questionnaires, are limited. While scalable trust games (e.g., those conducted in controlled environments) and statement approvals are useful, they can be difficult to implement broadly. Also, survey design doesn't necessarily constitute the various interpretations of trust and personal experience next to cognitive variability resulting in inconsistent behaviors and decision making.

Economic Lens on Trust

There are many theories of trust that draw from extensive literature across various disciplines within the social sciences, including political science, sociology, economics, and psychology. This broad base highlights the complexity and interdisciplinary nature of trust. In our study, we have chosen to examine trust through an economic lens, as economics frequently addresses market behaviors and rational decision-making. Further, we modeled trust and its interplay with *relational contracts,* which is *"*an economist's term for collaboration sustained by the shadow of the future as opposed to formal contracts enforced by the courts."[8] This framing is particularly relevant for the REAP Stakeholder Model, which emphasizes the interactions and behaviors of stakeholders within iEcosystems.

[8] Robert Gibbons and Rebecca Henderson, "Relational Contracts and Organizational Capabilities," Organization Science 23, no. 5 (2012): 1350–1364.

Expert Insights and Focus on Institutional Trust

To deepen our understanding of trust, we sought feedback from prominent economists, including Professors Roberto Rigobon and Robert Gibbons. Their insights helped clarify how trust is defined and measured and how it interplays with relational contracts. Additionally, we referenced guidelines from the OECD (Organization for Economic Co-operation and Development) library on how trust has been measured. The OECD distinguishes between interpersonal trust and institutional trust, providing a structured approach to understanding these concepts.[9]

In our study, we aggregate findings to focus on institutional trust, allowing us to model stakeholder relationships within an iEcosystem. This approach provides a clearer framework for analyzing how trust influences these interactions.

Key insights include:

- Firstly, trust is often confused with association and affinity; common interests do not equate to trust. Trust fundamentally "involves relying on the integrity, reliability, and credibility of someone or something," believing they will act consistently with expectations, obligations, or commitments.[10]

- "Trust is built over time through consistent behavior, transparency, honesty, and reliability." It forms the foundation of healthy relationships, cooperation, and societal structures.[11]

- Trust can also be indirectly measured by evaluating factors such as "communication effectiveness, reliability, integrity, competence, transparency, respecting deadlines, active engagement, etc."[12]

[9] OECD, OECD Guidelines on Measuring Trust, OECD Publishing, Paris, 2017, https://read.oecd-ilibrary.org/governance/oecd-guidelines-on-measuring-trust_9789264278219-en#page1
[10] Roberto Rigobon, *Advanced Applied Macroeconomics and International Institutions,* 15.723 (course material, Massachusetts Institute of Technology, 2024), and Roberto Rigobon, email to the Karen Luu, April 12, 2024.
[11] Rigobon, *Advanced Applied Macroeconomics and International Institutions*, and email to Karen Luu, April 12, 2024.
[12] Rigobon, *Advanced Applied Macroeconomics and International Institutions*, and email to Karen Luu, April 12, 2024.

Modeling Trust using Causal Loop Diagrams and Stock-and-Flows

To better understand the role of trust in innovation ecosystems, we develop causal loop diagrams (CLDs) and a stock-and-flow model that visualizes how trust evolves and influences stakeholder relationships. The models highlight key mechanisms of trust-building, setting the stage for deeper exploration in subsequent sections. The value of this approach becomes especially clear when applied to practice. Drawing on the REAP Madrid Case Study as a successful example, the analysis demonstrates how trust fosters resilient and collaborative relationships within iEcosystems and RIEs. To keep the discussion clear and accessible, the paper explains the models loop by loop, occasionally using a single loop as a representative example. The full set of comprehensive diagrams, however, is provided in the Appendix for reference.

Hypothesis

This working paper hypothesizes that place-based innovation initiatives, such as the National Science Foundation's Regional Innovation Engines (RIE) program, are designed to strengthen innovation ecosystems by fostering collaboration among universities, entrepreneurs, risk capital, corporations, and government institutions to drive economic growth. Within these innovation-driven ecosystems, trust-building plays an important role by supporting collaboration, minimizing friction, and promoting adaptability. While mechanisms like reputation and incentive alignment can facilitate relational contracts, trust-building becomes especially critical in settings marked by high uncertainty and ambiguity. In such contexts, trust supports relational contracts by encouraging forward-looking, cooperative behavior. In turn, these trust-rich dynamics contribute to iEcosystem stability and reduce the risk of systemic collapse.

REAP Madrid Case Study

The REAP Madrid Case Study provides a compelling model for understanding the dynamics and variables that contribute to the success of an innovation ecosystem. During the mid-2010s, Madrid, Spain, exhibited strengths among individual stakeholders but "historically struggled to build on those strengths to create a vibrant innovation ecosystem."[13] Despite having a robust university research base, a significant multinational corporate presence, and strong links to Latin America, Madrid failed to integrate these elements to foster innovation effectively.

In 2015, a group from Madrid applied to MIT's REAP program, to find new ways to accelerate their entrepreneurial ecosystem. Accepted into REAP Cohort 4, this REAP Team Madrid (https://reap.mit.edu/cohort/madrid-spain/) combined representatives of all five stakeholders (*government, corporates, universities, risk capital,* and *entrepreneurs*) from the MIT model. Together, they used the REAP program to explore the strengths and weaknesses of their regional ecosystem and then define a 'Must Win Battle' (MWB) for them to achieve collectively. Interestingly, REAP Team Madrid's MWB related to 'trust' within their regional ecosystem, so their 'intervention' was the creation of the 'Madrid Innovation Driven Entrepreneurship' (MIDE) program, and the website that connected all the stakeholders (https://www.mide.global/quienes-somos.php).

By modeling the successful REAP Madrid Case Study, this Paper identifies six reinforcing loops, each representing a virtuous cycle that contributed to the region's positive outcomes. The system dynamics model demonstrates that, although the potential gains from leveraging these "latent" strengths might seem obvious once articulated, "no particular stakeholder has the authority or resources to create these connections" independently.[14] Thus, this case study highlights the importance of collaborative efforts and integrated strategies to unlock the full potential of regional innovation ecosystems.

[13] Stern, Murray et al., "Accelerating Innovation Ecosystems," 27.
[14] Stern, Murray et al., "Accelerating Innovation Ecosystems," 27.

In the sections that follow, this Paper now examines each of the six Reinforcing Loops (RLs) individually. However, for the complete system dynamics model, refer to the diagram in the Appendix, Table 2, titled *Madrid Case Full Causal Loop Diagram*.

Reinforcing Loop 1 (R1): "Connectivity" Takeaways

The first reinforcing loop (R1), known as the Connectivity Loop, illustrates the role of *Initial Trust* in launching a self-reinforcing cycle that strengthens the regional innovation ecosystem. In this context, *Initial Trust* represents the baseline level of confidence and goodwill among stakeholders at the outset of collaboration, often grounded in prior relationships, institutional reputation, or shared objectives before formal projects begin. This trust becomes the spark that initiates cooperation, connectivity, and communication across the ecosystem.

This dynamic was clearly demonstrated in Madrid's experience. The ***Task Force Initiative***, a multi-year collaborative effort involving leaders from all five REAP stakeholder groups, served as the launching platform for collective engagement across the ecosystem. Through this initiative, the task force identified "the specific opportunities and bottlenecks in each of their respective areas to develop and implement a new and Madrid-specific approach."[15]

From this emerged the ***Madrid Innovation Driven Entrepreneurship (MIDE)*** network. MIDE became a vehicle for connecting people, organizations, ideas, and opportunities. That connective role became its true "Must-Win Battle."[16] While trust remained the essential catalyst, connectivity formed the infrastructure that propelled collaboration to flourish. As MIDE matured over the years, it fostered stronger partnerships, deepened trust, and created a reinforcing cycle of cooperation and innovation that helped solidify Madrid's position as a growing innovation hub.

[15] Stern, Murray et al., "Accelerating Innovation Ecosystems," 27.
[16] David Marquez, CEO and Director General at MIDE, email to Karen Luu, October 2025; and Álvaro Bernad, former CEO at MIDE, email to Karen Luu, September 2025.

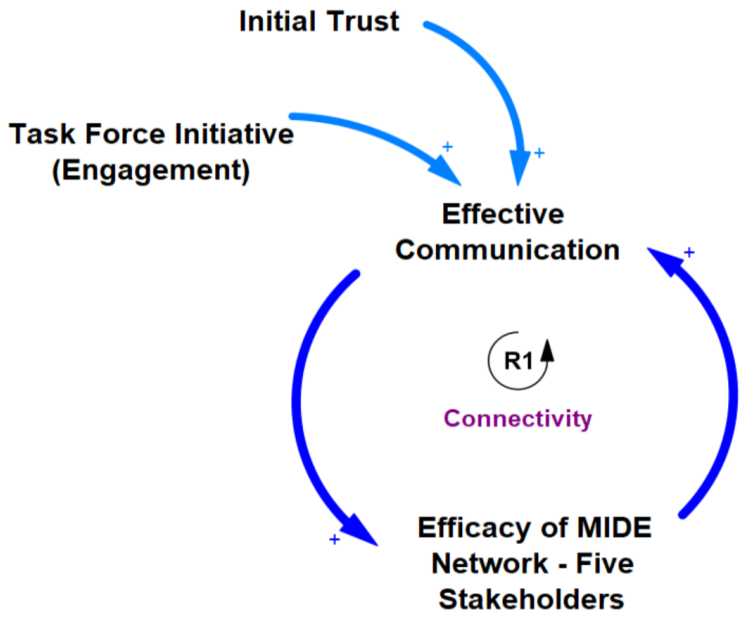


Figure 2.0 – The Connectivity Loop

- **Sparked by Initial Trust:** In this dynamic, network members are expected to effectively communicate with each other. As communication between members increases, so does the potential for higher trust among stakeholders. The *initial trust* is crucial for successful engagement and collaboration within the network. As stakeholders interact and collaborate more effectively, trust grows further. This increased trust enhances communication, creating a reinforcing loop that perpetuates continuous improvement and strengthens the network over time. (As later sections will show, Figure 4.0 later illustrates this accumulation of trust through a stock-and-flow model.)

- **Built on Connectivity:** A strong stakeholder network, sparked by *initial trust* and built on *effective communication*, enhances the network's connectivity—the continual exchange of information, resources, and relationships across the ecosystem. As these connections strengthen, stakeholders become more responsive to emerging opportunities and challenges. Over time, this growing connectivity reinforces the network's resilience, effectiveness, and adaptability, enabling the ecosystem to learn and evolve collectively.

Reinforcing Loop 2 (R2): "Logic Model" Takeaways

Reinforcing Loop 2 (R2), labeled Logic Model, illustrates how interconnected actions and feedback mechanisms drive continuous improvement within a system. *Effective communication, trust, agreement on committed initiatives, cooperation, shared assessments of opportunities,* and *strategic interventions accelerating productivity* drive this loop. By nurturing these elements, stakeholders can create a virtuous cycle of ongoing enhancement.

The Logic Model loop centers on an ecosystem or RIE's ability to design to "remove a key bottleneck, leverage previously under-tapped latent capability, or introduce a new capacity to address an economically significant weakness in the current state of the regional innovation ecosystem."[17] Reinforcing Loop 2 (R2) provides valuable insights into continuous improvement within systems.

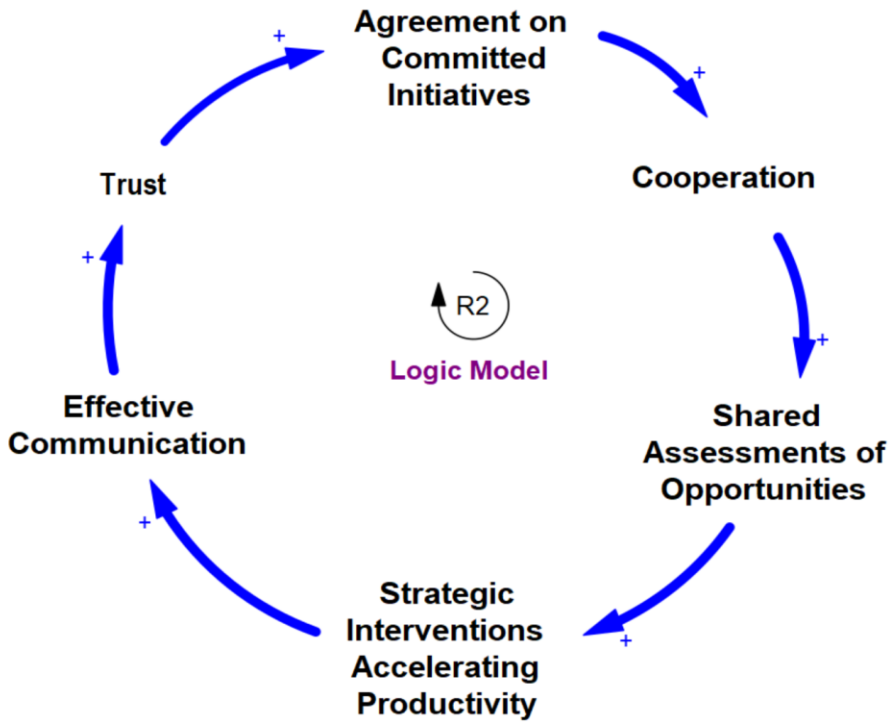


Figure 2.1 – The Logic Model Loop

[17] Stern et al., "Accelerating Innovation Ecosystems," 5.

- **The Power of Communication:** *Effective communication* is the cornerstone of R2. Clear and open communication channels not only facilitate the exchange of information but also solidify any trust among stakeholders. Trust grows when information flows equally and consistently, reducing misunderstandings and creating confidence that all parties are aligned. Building this foundation of trust through communication is what enables meaningful agreements to emerge.

- **Consensus Through Agreement:** Agreement represents a shared understanding of initiatives, goals, and strategies, and it signifies that trust has reached a level strong enough to maintain collaboration. When stakeholders have confidence in one another's intentions and commitments, they are more willing to align objectives, streamline decision-making, and foster unity. Thus, agreement is not merely procedural consensus; it is also an expression of trust in both the process and the people involved. In Madrid's case, this was exemplified by initiatives such as the *Call for Innovation on Circular Economy* with Sacyr, where multiple actors jointly committed to addressing shared challenges, demonstrating how trust-enabled agreements can mobilize coordinated action across the ecosystem.

- **The Emergence of Cooperation:** *Cooperation* emerges naturally from agreements built on trust. When stakeholders collaborate, they pool resources and coordinate actions, leading to synergistic outcomes. Cooperation enhances the system's capacity to address challenges and seize opportunities, making collective efforts more effective.

- **From Insight to Action:** Cooperation enables thorough *shared assessments*, which are critical evaluations of the system's performance. Assessments provide valuable data and insights, inform decisions, identify areas for opportunities for the region. Regular systematic assessments shared among the stakeholders ensure that the system remains aligned, responsive, and adaptive. Informed by the assessments, strategic interventions are targeted actions designed to

address specific issues or opportunities. These interventions are evidence-based and adaptive, driving the system towards its goals. Effective strategic interventions are essential for achieving continuous improvements.

Reinforcing Loop 3 (R3): "Acceleration" Takeaways

The Acceleration loop (R3) underscores the importance of communication and collaboration in fostering a thriving innovation ecosystem. Stakeholders can achieve rapid progress and continuous growth by continuously reinforcing *effective communication*, sharing and *agreeing on potential opportunities*, *aligning on shareholders' performance expectations*, and identifying *strategic interventions that would accelerate productivity.*

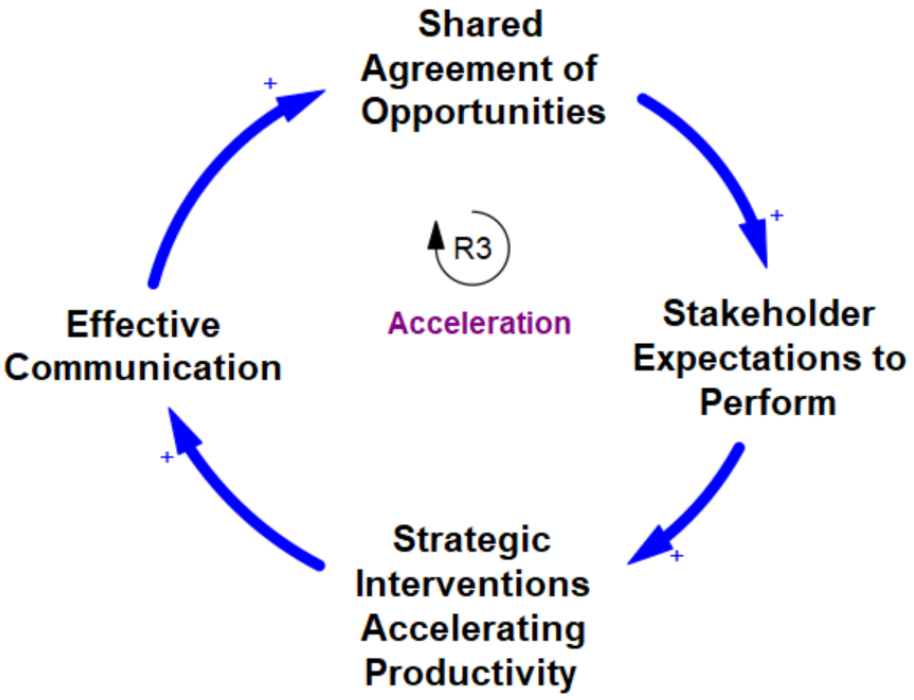


Figure 2.2 – The Acceleration Loop

- **Exercise Powerful Motivators:** Reaching agreements naturally raises the expectations of all stakeholders involved. High expectations can act as a powerful motivator, encouraging stakeholders to aim for higher performance and greater outcomes. When stakeholders believe their collective efforts can lead to significant results, they are more likely to commit resources and energy to their initiatives. This loop exemplifies how a virtuous cycle can lead to exponential improvements driving an ecosystem towards higher levels of innovation success.

- **Harness the Full Potential:** Fostering an environment that encourages open communication and collaboration among stakeholders can significantly enhance the effectiveness of an innovation ecosystem. Creating platforms for dialogue, goal alignment, and joint interventions allows stakeholders to coordinate actions and share insights more effectively. When stakeholders communicate transparently and work toward shared objectives, they unlock the full potential of the *Acceleration Loop*, driving faster progress, stronger engagement, and higher innovation output. The *MIDE LATAM Bootcamp*, supported by partners such as *The Cube* and *Pascual Innoventures***,** exemplified this dynamic through mentorship, investor engagement, and cross-border collaboration that accelerated startup growth and ecosystem connectivity.[18]

Reinforcing Loop 4 (R4): "Collaboration" Takeaways

In Figure 2.3 below, the reinforcing loop R4, known as the Collaboration loop, demonstrates how stakeholder cooperation can elevate *performance expectations*, foster *synergistic partnerships*, enhance the *willingness to enable reciprocal programs*, and ultimately increases the *willingness to support innovation-driven entrepreneurship* within an ecosystem. This loop exemplifies the dynamic interplay of various elements

[18] David Marquez, CEO and Director General at MIDE, email to Karen Luu, October 2025.

that can transform an innovative ecosystem from fragmented efforts into a cohesive and thriving environment.

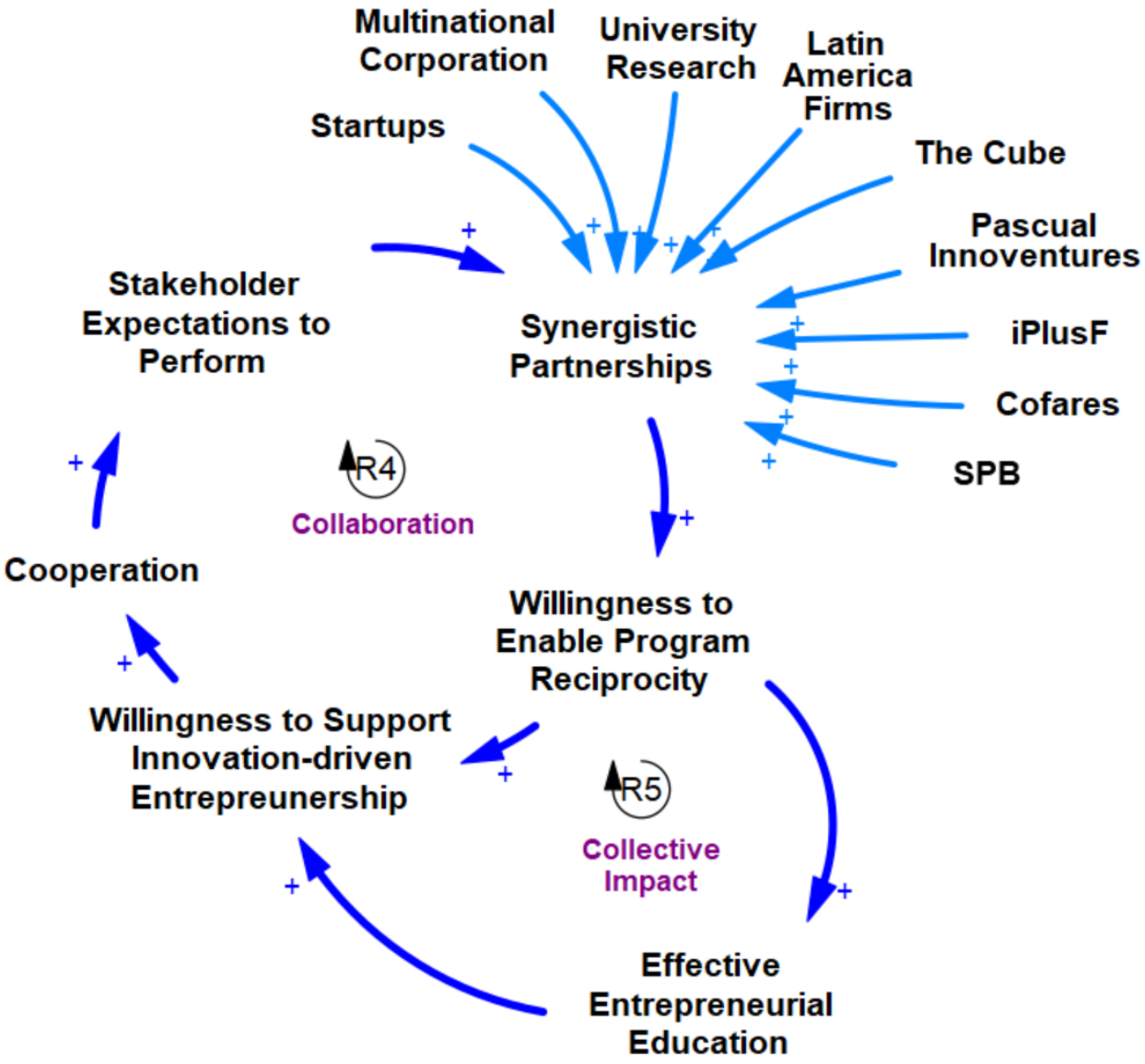


Figure 2.3 – The Collaboration Loop and Collective Impact Loop

- **Set the Stage:** Effective cooperation allows these stakeholders to work together, share resources, and align their efforts toward common objectives. This initial cooperation lays the groundwork for more complex interactions and synergies.

As cooperation increases, stakeholders' expectations for successful outcomes also rise. This heightened anticipation motivates them to invest more time, effort, and resources into collaborative initiatives. Higher expectations create a sense of urgency and purpose, driving stakeholders to aim for higher performance and more ambitious goals. In Madrid, the success of early cooperative efforts, including the Task Force Initiative and the establishment of the Madrid Innovation Driven Entrepreneurship (MIDE), significantly raised performance expectations regarding the potential of collective achievement.

- **Create Synergies:** Elevated cooperation and expectations naturally lead to the formation of robust partnerships. These valuable partnerships in Madrid involved various combinations of startups, multinational corporations, university research groups, firms from Latin America, The Cube, Pascual Innoventures, iPlusF, Cofares, and SPB. These collaborations leveraged the unique strengths of each stakeholder, creating synergies that drive innovation and potential catalytic effects. Yet, Kania and Kramer remind us, “Collaboration is nothing new.”[19] What distinguished Madrid’s approach was its commitment to *collective impact* through aligning diverse stakeholders around a shared agenda and continuing joint efforts to address challenges rooted in social change. This alignment transformed partnerships from ad hoc collaborations into purposeful vehicles of systemic change.

- **Reciprocate Partnerships:** Each partner's diverse capabilities and resources are harnessed to tackle challenges and seize opportunities more effectively. Synergistic partnerships enhance the willingness to support reciprocal programs, where stakeholders mutually benefit from each other’s resources, knowledge, and capabilities. The Madrid Innovation Driven Entrepreneurship (MIDE) network facilitated connections between startups and multinational corporations, providing mutual benefits and fostering a collaborative environment. This reciprocity ensures that all parties gain value from the collaboration, strengthening the

[19] John Kania and Mark Kramer, “Collective Impact,” Stanford Social Innovation Review 9, no. 1 (Winter 2011): 36.

partnerships. Thus, this led to a thriving environment of innovation-driven entrepreneurship, reinforcing the cooperative spirit among stakeholders.

Building on these findings, the Madrid Innovation Driven Entrepreneurship (MIDE) initiative demonstrates how the reinforcing effects of trust and connectivity translate from theory into practice. Since its inception, MIDE has connected people, organizations, ideas, and opportunities – showing that while trust enables cooperation, connectivity provides the structural base for enduring collaboration and shared success.

Moreover, one of MIDE's greatest strengths lies in its partners, who function as active levers within the ecosystem – organizations such as **The Cube**, **Pascual Innoventures**, **iPlusF**, **Cofares**, and **SPB**. These partners not only contribute resources and expertise but also expand the network's connective tissue, accelerating innovation through their distinct domains of influence.

- ✓ **The Cube**, for instance, has been one of Madrid's most visible champions of ecosystem dynamization. Through initiatives such as *BeyondX*, *MIOTI (Madrid Innovation & Open Technology Institute)*, and numerous training programs, The Cube has created tangible meeting points for entrepreneurs, corporates, investors, and universities.
    - *BeyondX* organizes innovation workshops, startup showcases, and hackathons that connect founders with mentors and potential clients.
    - *MIOTI* serves as an open innovation platform, allowing corporations to launch technological challenges and collaborate directly with startups.
    - Its educational initiatives, from bootcamps to technical or specialized workshops, have elevated Madrid's talent base, generating a reinforcing acceleration effect across the ecosystem.

  Complementing these initiatives, *Insurtech Day*, co-organized with The Cube and leading insurance companies, exemplified how targeted events can create synergies between startups, corporates, and academia. Acting as both collaborator and co-facilitator, The Cube strengthens cooperation by bridging

ecosystem agents, scouting startups, fostering partnerships, and coordinating across corporate and academic spheres.

- ✓ **Pascual Innoventures** has emerged as a strategic force in the *Foodtech* domain, advancing innovation through thematic calls, startup collaborations, and its investment arm. By providing capital, mentorship, and access to markets, Pascual Innoventures has helped solidify Madrid's position as a national and international Foodtech hub.

- ✓ **iPlusF** plays a pivotal role in the management of grants, subsidies, and financing for startups and innovation projects. Its ongoing communication with corporates, entrepreneurs, and institutions ensures that funding opportunities are effectively matched with capable projects — transforming administrative processes into accelerators of innovation maturity.

- ✓ In the *Healthtech* space, **Cofares** stands out as a key enabler, leveraging its reach in pharmaceutical logistics and healthcare networks to help startups scale within Spain.

- ✓ Similarly, **SPB**, a benchmark company based in the Valencian Community, continues to strengthen Madrid's innovation landscape through open innovation and cross-regional collaboration, bridging distinct innovation hubs across Spain.[20]

[20] David Marquez, CEO and Director General at MIDE, email to Karen Luu, October 2025.

Reinforcing Loop 5 (R5): "Collective Impact" Takeaways

The Collective Impact loop (R5) in Figure 2.3 illustrates how a cycle of *cooperation, stakeholder performance expectations, synergistic partnerships, willingness to enable program reciprocity, entrepreneurial education,* and *willingness to support innovation-driven entrepreneurship* can transform an ecosystem. Ultimately, strengthened program reciprocity can lead to greater effectiveness in entrepreneurial education.

As highlighted by Kania and Kramer, "Collective impact initiatives are distinctly different. Unlike collaborations, collective impact initiatives involve a centralized infrastructure, a dedicated staff, and a structured process that leads to a common agenda, shared measurement, continuous communication, and mutually reinforcing activities among all participants."[21] This structured approach ensures a more coordinated path to achieving meaningful outcomes, aiming to foster an entrepreneurial ethos in the ecosystem. In Madrid's case, *La Radiografía de Innovación y Emprendimiento* embodied this principle – bringing together more than 70 stakeholders, including iPlusF, universities, and corporates, to co-develop a shared agenda and align collective efforts around the region's ecosystem goals.[22]

- **Share Beneficial Knowledge:** As stakeholders are willing to engage in reciprocal programs, they share knowledge and best practices, which help to create the collective impact philosophy. This educational exchange is vital as it cultivates a mindset oriented towards innovation and risk-taking. Entrepreneurial education equips individuals with the necessary skills and knowledge and fosters a broader ethos shift toward embracing entrepreneurship.

- **Shape Innovation Culture:** Entrepreneurial education does more than equip individuals with skills; it gradually shapes the culture of an ecosystem. This cultural shift influences whether innovation can take root and thrive. As Prof. Stern et al.'s research observes, "to help realize a thriving innovation ecosystem,

[21] John Kania and Mark Kramer, "Collective Impact," Stanford Social Innovation Review 9, no. 1 (Winter 2011): 36-38.
[22] David Marquez, CEO and Director General at MIDE, email to Karen Luu, October 2025.

each Engine is expected to embody a culture of innovation throughout its management structure, processes, partners, and stakeholders, and in carrying out its core functions."[23]

To better understand how this operates, it is also useful to distinguish between two levels of culture, as outlined in *Strategy Meets Culture (for Breakfast)* [24]*.* These are often referred to as *Big-C Culture* and *Little-c Culture*.

- The Big-C Culture*:* refers to the overarching, macro-level and "captures aspects of societal culture," that define a society, organization, or industry. It includes broader values that act as "criteria or standards of preference" and "may affect organizational design, decision-making, and performance."[25] In practice, this means Big-C Culture sets the overarching norms and guiding principles that influence how institutions operate at a structural level.

- The Little-c Culture*:* reflects on the micro-level and emerges in the day-to-day actions. Rather than focusing on broader societal values, it centers on "expectations rather than on values, and it is changed by intentional interventions rather than by exogenous events."[26] Put simply, Little-c Culture emerges in the daily interactions between individuals and groups and can be influenced directly through practices, interventions, and relationship-building.

Together, Big-C and Little-c Culture highlight how broader values, and everyday practices interact to shape an ecosystem's capacity for innovation. When culture is aligned at both macro and micro levels and reinforced by stakeholder

[23] National Science Foundation, NSF Regional Innovation Engines (NSF Engines) Broad Agency Announcement (BAA), accessed March 29, 2024, https://new.nsf.gov/funding/initiatives/regional-innovation-engines.
[24] Gibbons, Robert, Jordan Siegel, and Roberto A. Weber. "Strategy Meets Culture (for Breakfast): Understanding the Relationship and Highlighting Its Potential." Strategy Science 6, no. 2 (June 2021): 111–118.
[25] Gibbons, Siegel, and Weber, "Strategy Meets Culture," 112-118.
[26] Gibbons, Siegel, and Weber, "Strategy Meets Culture," 112-118.

collaboration, ecosystems are better positioned to address latent gaps and support growth.

- **Attract Top Talent:** “The role of culture and incentives is even more relevant because it shapes the regional supply of human capital through migration.”[27] Regions with a strong entrepreneurial culture and robust educational programs attract talented individuals who are eager to innovate and start new ventures. This migration enhances the local talent pool, further boosting the region's innovation and economic growth capacity.

Reinforcing Loop 4 (R6): “Trusting Relationships” Takeaways

Reinforcing Loop R6, the Trusting Relationships loop, highlights the pivotal role of trust as the connective tissue binding together the ecosystem’s key elements: *stakeholder expectations, synergistic partnerships, program reciprocity,* and *support for innovation-driven entrepreneurship.*

As seen in the previous loops, these variables already serve to align objectives, mobilize resources, and strengthen partnerships. Below in Figure 2.4, trust amplifies their collective impact by creating the confidence necessary for stakeholders to make and honor commitments. When trust is strong, agreements are easier to forge and far more likely to be upheld, reinforcing performance expectations and deepening engagement.

[27] Stern et al., "Accelerating Innovation Ecosystems," 33.

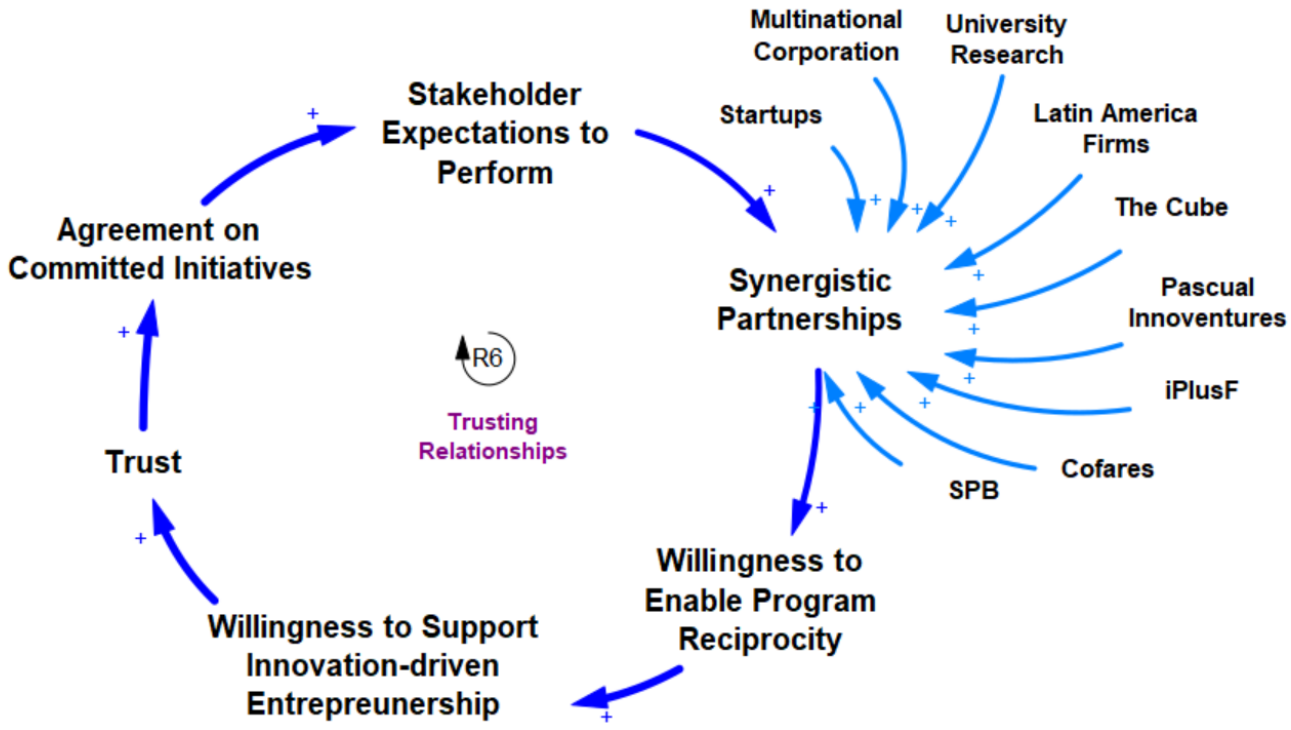


Figure 2.4 – The Trusting Relationship Loop

In Madrid, the cultivation of trust among stakeholders proved central to ecosystem expansion. It not only strengthened existing relationships but also encouraged new partnerships across startups, university research groups, Latin American firms, and key ecosystem accelerators such as *The Cube, Pascual Innoventures, iPlusF, Cofares,* and *SPB.* The continuous collaboration seen in programs like *Puentes de Talento*, recurring partnerships with *The Cube*, *Pascual Innoventures'* confidence in emerging startups, and *iPlusF's* consistent facilitation of partnerships all reflect how trust fuels cooperation and reciprocity. This ultimately enhanced stakeholders' willingness to support innovation-driven entrepreneurship, closing the loop and reinforcing the relationships that contribute to ecosystem growth. It is important to note that Madrid's ecosystem shows that when leadership is shared among diverse players, it can drive innovation more effectively than a single, dominant voice. This diversity has turned out to be one of

the ecosystem's greatest strengths.

- ✓ **Corporates** such as The Cube and Pascual Innoventures have often taken the lead, driving open innovation challenges, co-organizing programs, and assuming visible leadership roles.

- ✓ **Venture investors** have been instrumental in scaling initiatives like the *MIDE LatAm Bootcamp*.

- ✓ **Public institutions** have also played a decisive role through initiatives such as *Puentes de Talento* (a collaboration between Ayuntamiento de Madrid and the Inter-American Development Bank), *Radiografía de la Innovación y el Emprendimiento* executed by MIDE, and *Innobars* and *Innoday* events in partnership with Comunidad de Madrid and Fundación Madrid.

While leadership has shifted over time, this diversity of drivers has proven valuable. Many impactful initiatives emerged outside of the MIDE brand itself, such as thematic sessions on Insurtech, AI, Circular Economy, and the *Puentes de Talento* program. Yet collectively, they contributed to reinforcing trust and collaboration within the broader innovation ecosystem.[28]

The Downward Spiral of Trust Loss

While the Madrid case was a success story, we modeled a scenario to clearly illustrate the potential impact of 'trust loss' on an innovation ecosystem. (Refer to the complete diagram in the Appendix, Table 4, titled *The Downward Spiral of Trust Loss*.) A breakdown of trust triggers a chain of interconnected issues that destabilize the entire system. When trust erodes, it leads to ineffective communication among stakeholders, reducing engagement and weakening cooperation. As communication breaks down,

[28] David Marquez, CEO and Director General at MIDE, email to Karen Luu, October 2025.

commitments are not honored, and expectations are unmet, further deteriorating the ability to collaborate and work toward shared goals.

This loss of trust also negatively affects crucial partnerships between entities like startups, universities, and corporations. As these partnerships become misaligned, they struggle to collaborate effectively, making it harder to drive innovation and support entrepreneurial efforts. Over time, programs designed to foster entrepreneurship and innovation become less effective, and the ecosystem begins to stagnate.

Trust loss initiates a self-reinforcing vicious cycle, where poor communication and disengagement fuel further breakdowns in cooperation and misaligned initiatives. This makes it harder for stakeholders to find new opportunities or maintain productive partnerships, significantly slowing progress and innovation.

In summary, loss of trust creates a vicious cycle of poor communication, weakened partnerships, and slowed innovation, ultimately harming everyone involved in the ecosystem. Rebuilding trust and realigning goals among stakeholders would be crucial to restoring cooperation and driving progress.

Key ‘Leverage Points’ Propel Innovation Ecosystems

In system dynamics, and particularly within the complex realm of innovation ecosystems, certain strategic areas, known as **leverage points**, hold the potential to create substantial impacts with a minor shift. Leverage points provide powerful entryways for understanding and influencing system behavior, enabling ecosystems to move more effectively toward desired outcomes.

Focusing on the leverage points of effective *Communication, Agreement, Cooperation, and Partnerships* can unlock significant improvements across an innovation ecosystem. Trust operates as the reinforcing mechanism across these areas, both the product of effective interaction and the enabler of deeper collaboration. By strengthening these dynamics, iEcosystems and RIEs can accelerate innovation, foster growth, and create

thriving environments where all stakeholders contribute and benefit.

- **Effective communication** helps build trust by ensuring that stakeholders are well-informed, transparent, and aligned. When paired with **agreement on committed initiatives,** it channels efforts toward shared goals and fosters genuine commitment to strategies.

- **Cooperation** strengthens relationships by enhancing resource sharing and joint problem-solving, reinforcing the network of trust and reciprocity within the ecosystem.

- Strategic and **synergistic partnerships** leverage the unique strengths of different stakeholders, expand opportunities, and drive the growth of an entrepreneurial culture that thrives on collaboration.

Reflection: Madrid's Momentum Built on Trust

Taken together, the Madrid Case causal loop diagram illustrates how reinforcing dynamics rooted in the leverage points of *communication, agreement, cooperation, and partnerships,* while anchored in *trust*, can accelerate the growth of innovation ecosystems. At the same time, these very leverage points can become vulnerabilities: when communication breaks down, agreements falter, or trust erodes, the loops shift from reinforcing growth to destabilizing the system.

The formation of the Madrid Innovation Driven Entrepreneurship (MIDE) network provides a concrete example. By supporting start-ups positioned to benefit from multinational partnerships and leveraging Madrid's ties to Latin America through reciprocal programs, MIDE created new pathways for both regional and global market access. As the strategy unfolded, each element of this effort "depended on sustained

engagement (and trust)" [29] across a diverse set of stakeholders, echoing the loop takeaways identified in the model.

The successful scaling of MIDE demonstrates how trust-based reciprocity can transform latent opportunities into tangible outcomes. It serves as a powerful closing lesson on how stakeholder-led initiatives, when grounded in trust, can generate ecosystem-wide impact and long-term resilience. As David Márquez, CEO and Director General at MIDE, noted thoughtfully, "In our experience, people are more important than institutions. It is the commitment of individuals – entrepreneurs, professors, civil servants, corporate champions, and partners – that has made the difference so far."[30]

Recommendations from the Madrid Case Study Insights

The case study highlights the critical factors and dynamics influencing the success of the Madrid innovation ecosystem. Each reinforcing loop (R1-R6) demonstrates how various elements, such as trust, communication, connectivity, collaboration, and cultural development, interact to drive continuous improvement and innovation. However, the system is also vulnerable to disruptions, such as loss of trust, which can have significant negative impacts.

- **Enhance Trust-Building Initiatives**:
  - Invest in Trust-building Activities: (e.g., team-building exercises, regular progress meetings, training programs, joint problem-solving workshops, and transparent decision-making processes, etc.) across all stakeholder groups. Ensure transparency, reliability, and honesty in all interactions to foster a robust foundation of trust.

[29] Stern et al., "Accelerating Innovation Ecosystems," 27-28.
[30] David Marquez, CEO and Director General at MIDE, email to Karen Luu, October 2025.

- Address Gaps in Accountability*:* When accountability mechanisms are lacking or weakened, increase transparency to mitigate the impact. Providing clear communication about who is responsible and what actions are being taken ensures stakeholders remain informed and confident in the process, helping to restore and reinforce accountability. Monitor and promptly address any issues that could undermine trust, such as fraud or contract breaches.

- **Foster Effective Communication:**

  - Create Communication Systems**:** Establish platforms and processes that enable open and transparent dialogue among stakeholders. Use these systems to align goals and strategies, ensuring that information flows seamlessly to minimize misunderstandings and prevent conflict. Document aligned agreements clearly and build in regular feedback loops so that all parties remain informed, engaged, and confident in the process.

- **Strengthen Collaboration and Partnerships:**

  - Facilitate Robust Partnerships: Encourage the formation of partnerships that leverage the unique strengths of diverse stakeholders (including startups, multinational corporations, academic institutions, and others) to create collaborations that are both strategic and mutually beneficial.

  - Promote Program Reciprocity: Foster an ethos of give-and-take to ensure that collaboration remains balanced and workable. By sharing resources, knowledge, and opportunities, stakeholders not only contribute to the ecosystem but also gain tangible benefits that reinforce trust and long-term commitment.

Madrid in Context: Toward Broader Trust Models

Drawing from the REAP Madrid Case Study documented in Stern et al.'s research paper, we modeled the dynamics of what unfolded to better understand why it became a success story. By translating the narrative of Madrid's strategy into a causal loop diagram, we can see not only what was done in practice, but also why those actions worked to strengthen stakeholder engagement, trust, connectivity, and reciprocity. As David Márquez, CEO and Director General at MIDE, reflected, "The trust model shows what is possible, but it is a continuous and fragile process. We see our progress not as final, but as evidence that when diverse stakeholders connect with purpose, the ecosystem can unlock value iteratively."[31] This modeling approach allows us to learn directly from Madrid's experience and apply those insights more broadly to other iEcosystems.

Having examined how Madrid's experience can be understood through system dynamics, the focus now shifts to broader trust models expressed through causal loop diagrams (CLD). This can also provide a wider framework for analyzing the causal relationships that underpin trust and relational contracts within innovation ecosystems. The discussion then concludes with a comprehensive trust model that depicts trust as a 'stock' (an accumulation of trust-building over time), offering a system-wide perspective on how trust can evolve and impact ecosystem performance.

[31] David Marquez, CEO and Director General at MIDE, email to Karen Luu, October 2025.

The Causal Relationships of Trust

This full model, titled *The Causal Relationships of Trust*, illustrates the interconnected factors that contribute to building and maintaining trust. It highlights three key reinforcing loops (R1 – Cooperation, R2 – Agreement, and R3 – Understanding), each representing different aspects of trust dynamics and ultimately their influence on relational contracts.

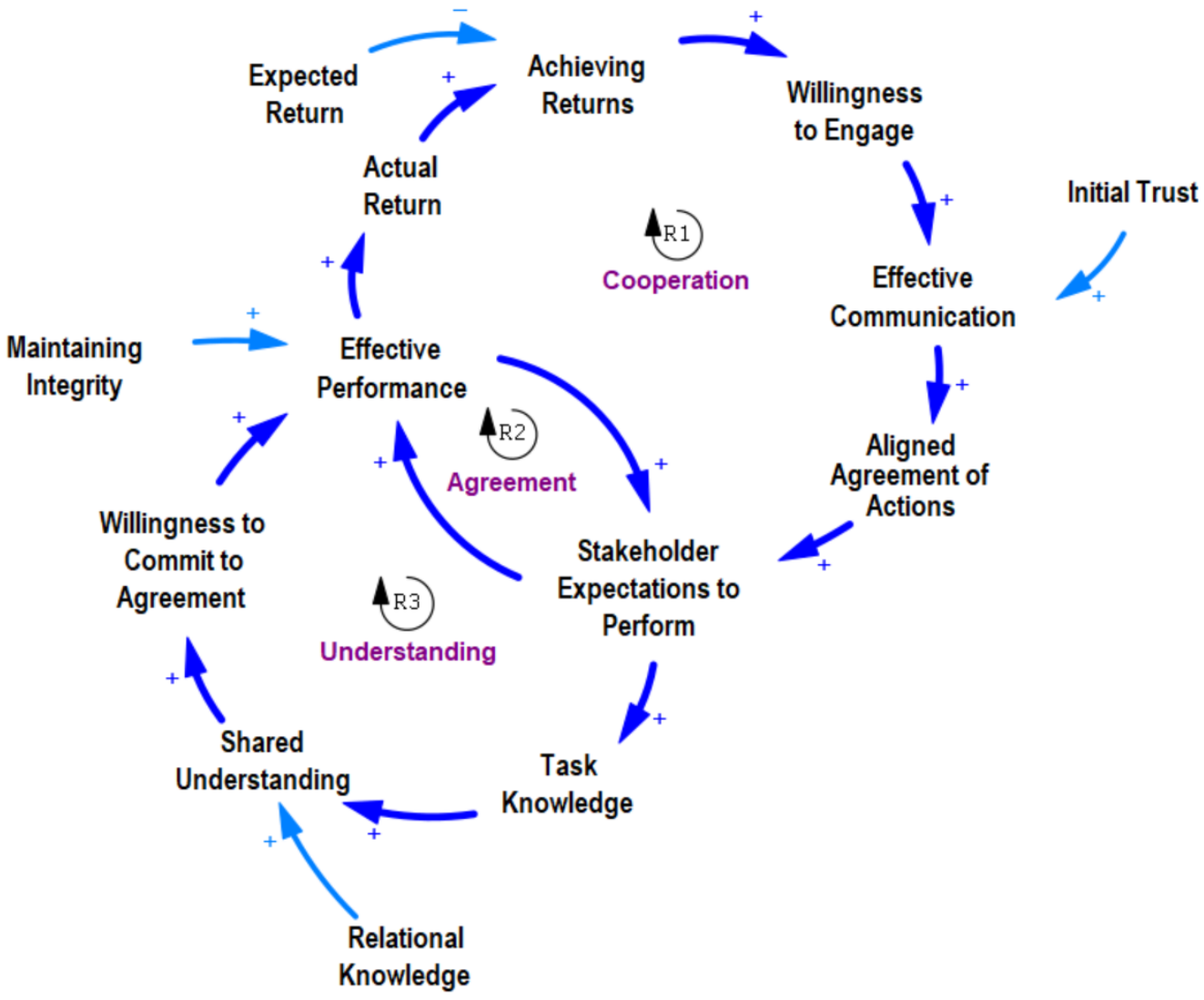


Figure 3.0 – Loops: Cooperation (R1), Agreement (R2), Understanding (R3)

Together, these loops create a dynamic and self-sustaining system of trust within ecosystems. Additionally, the diagram demonstrates how these trust-building mechanisms connect to the dynamics and effectiveness of relational contracts, particularly as they evolve further within the R2 (Agreement) and R3 (Understanding) loops. Moving forward, we will further explore building trust, define relational contracts, and study their interplay within iEcosystems.

This Paper now turns to the exploration of these three Reinforcing Loops (RLs), analyzing each in sequence.

Reinforcing Loop 1 (R1): "Cooperation" Takeaways

Reinforcing Loop R1, labeled as the Cooperation loop, illustrates how *effective communication* among stakeholders can initiate a positive feedback cycle that enhances *cooperation, willingness to engage*, overall *performance* and *return results* within an innovation ecosystem. As shown in the previous Madrid Case Study model, this process begins with *initial trust*—the baseline level of confidence and goodwill among stakeholders at the beginning, often built on prior relationships, institutional reputation, or shared objectives before formal collaboration begins. This trust provides the foundation for bilateral communication and active participation, which in turn supports alignment, fosters collaboration, and drives growth.

- **Prioritize Clear Communication:** *Effective communication* is the foundational element of the Cooperation Loop. It ensures that stakeholders are well-informed, aligned, and able to share their goals and expectations. Clear and open lines of communication foster mutual understanding, which is essential for reaching strong agreements. Communication facilitates the alignment of stakeholders on common goals and strategies, setting the foundation for coordinated action.

- **Motivate Stakeholder Investment:** Reaching *agreements* is the next critical step in the loop. Agreements align efforts and ensure all stakeholders commit to the same objectives and actions. Agreements raise stakeholders' expectations by establishing clear goals and benchmarks for success. These stakeholder expectations to perform, in turn, motivate stakeholders to invest effort and resources into their cooperative initiatives, driving them to strive towards these targets. Improved performance is the direct outcome of these raised expectations. When stakeholders believe in the potential for success, they are more likely to contribute actively.

- **Cultivate a Trustworthy and Reliable Environment:** *Achieving returns* is realized through improved and *effective performance* influencing *actual returns*. When actual outcomes meet or exceed the agreed-upon expectations, stakeholders recognize significant value from their investment of effort, time, and resources. This validation encourages stakeholders to continue engaging in collaborative efforts as they see tangible benefits from their contributions. The positive feedback from achieving returns further reinforces stakeholders' commitment and trust in the cooperative process.

  Integrity links to e*ffective performance* by building honesty and trustworthiness and fostering a culture of ethical behavior, commitment, and reliability. These elements create an environment conducive to effective cooperation and high performance.

- **Uphold High Stakeholder Engagement:** Increased *willingness to engage* is the final link in the Cooperation Loop. High levels of engagement are critical for maintaining the cycle. Engaged stakeholders are more likely to remain actively involved, continue communicating effectively, reach new agreements, and strive for high performance. This constant engagement promotes further communication, restarting and reinforcing the entire loop.

Reinforcing Loop 2 (R2): "Agreement" Takeaways

The Agreement loop (R2) demonstrates how effective performance validates cooperative efforts, confirming that *agreements* and *expectations* were well-founded. Positive results strengthen stakeholders' confidence in the value of collaboration, motivating them to remain engaged and committed.

Notably, this loop also highlights how trust influences relational contracts and was initially introduced in the Cooperation loop (R1). In particular, the variables *Aligned Agreement of Actions* and *Stakeholder Expectations to Perform* reinforce how agreements, when honored, translate into deeper commitment. This lays the basis for long-term cooperation and the effectiveness of relational contracts.

- **Elevate Goals and Achieve Excellence**: Strong performance can raise expectations. When stakeholders see their collaborative efforts leading to successful outcomes, they set higher expectations for future performance. These elevated expectations motivate stakeholders to strive for greater achievements, investing more effort and resources to meet or exceed these goals. This increased motivation is critical for driving continuous improvement within the ecosystem.

Reinforcing Loop 3 (R3): "Understanding" Takeaways

The Understanding Loop (R3) in an innovation ecosystem illustrates a self-reinforcing cycle of continuous improvement driven by high *expectations to perform, task knowledge, shared understanding, relational knowledge, willingness to commit to agreement,* and *effective performance*.

The Understanding Loop (R3) highlights how knowledge-share and alignment strengthen collaboration in innovation ecosystems. Relational contracts, viewed through

the lens of economics, can be understood as informal agreements sustained not by legal enforcement but by shared understanding. Developing such contracts requires consistent communication and deeper insight into each stakeholder's roles, capabilities, and expectations. Within this loop, relational contracts operate in dynamic interplay with trust-building, shaping how stakeholders cooperate, adapt, and collaborate in complex iEcosystems.

- **Develop 'Shared Understanding' to build Relational Contracts:**

    - Defining Relational Contracts: Relational contracts are informal agreements and "building a relational contract requires developing a shared understanding."[32] Because relational contracts rely on *Shared Understanding'* rather than legal enforcement, they will require more frequent and transparent communication. This shared understanding, which is built on *task knowledge* and *relational knowledge*, is essential for coordinating efforts, minimizing misunderstandings, and enabling more effective cooperation among stakeholders.

    - Role of Expectations and 'Task Knowledge': Clear *Stakeholder expectations to perform* should establish clear standards, thus motivating stakeholders to develop the necessary *Task Knowledge* to meet these expectations. This knowledge specifies "what each party is supposed to do,"[33] thereby fostering alignment and shared understanding among stakeholders.

    - 'Relational Knowledge' Through Interaction: Regular interactions could enable stakeholders to learn about each other's capabilities, reliability, and responses to various situations. This process can cultivate *Relational Knowledge* (defined as understanding "what each party *could* do, either to

[32] Gibbons and Henderson, "Relational Contracts," 1352.
[33] Gibbons and Henderson, "Relational Contracts," 1352.

break a promise or to punish someone who did, and what the payoffs from all the possible actions are.")[34] With this knowledge, stakeholders can better anticipate one another's actions, align their behavior, and avoid conflict.

- **Strengthen Willingness to Commit:** A high *willingness to commit* to the *aligned agreements* drives improved performance, as stakeholders are motivated to perform at their best. This improved performance validates cooperative efforts and raises future expectations, perpetuating the cycle. *Integrity* plays a critical role in building a trustworthy environment, ensuring consistent an d reliable actions that enhance performance.

The Impact of an 'Achievement Gap': The "Collapse" Loop

Conversely, when the *actual returns* are less than *expected returns*, an 'achievement gap' forms. This gap marks the point where the initial vision no longer aligns with realized performance, signaling a breakdown between expectation and reality. Such discrepancies often undermine confidence in the collaboration's processes and long-term viability. As uncertainty grows, stakeholders begin to reassess whether their investments in time, effort, and resources are generating the anticipated results. This dynamic sets the stage for what the model identifies as the *Collapse Loop* in Figure 3.1, a balancing feedback process that illustrates how an achievement gap can start to destabilize the system.

[34] Gibbons and Henderson, "Relational Contracts," 1352.

Figure 3.1 – The Collapse Loop

As confidence wanes, the willingness to engage slips. Stakeholders who were once willing to meet, share ideas, and coordinate efforts start showing up less, or contribute less actively. With fewer meaningful interactions, communication suffers. And when communication breaks down, it becomes harder to maintain alignment on shared goals.

Without alignment, agreements start to lose their grip. Expectations for performance are quietly lowered, and with that, motivation takes a hit. Lower motivation leads to weaker performance, widening the gap between what was hoped for and what is actually delivered. That performance gap, in turn, further erodes trust and commitment, setting in motion a reinforcing loop that accelerates the decline. Left unchecked, this cycle can turn a promising initiative into a quiet and slow-moving collapse.

Implications and Recommendations for Strengthening Innovative Ecosystems

The overall analysis of causal relationships of trust-building and its dynamics with relational contracts within innovation ecosystems underscores that institutional trust depends on a delicate balance of factors. *Effective communication, aligned agreements, shared understanding, commitment,* and *integrity* all interact to build stakeholder engagement and continuous improvement. Together, these elements form the backbone of a resilient ecosystem, allowing diverse stakeholders to coordinate, adapt, and pursue shared objectives.

Implications:

- The implications are clear: disruptions such as achievement gaps (when *actual returns* are less than *expected returns*) can destabilize these ecosystems, leading to a breakdown in communication, weakening agreements, and reducing overall performance.

Recommendations from the Trust Causal Loop Diagram (CLD) Insights:

The following recommendations build on insights from the trust causal loop diagram, informed by practical experience in stakeholder collaboration as well as lessons from past studies. They are intended to translate the model's dynamics into actionable strategies for strengthening innovation ecosystems.

- **Prioritize Clear Communication:**
  - Implement Regular Updates: Schedule weekly or bi-weekly updates through email newsletters, team meetings, and video conferences to ensure all stakeholders are informed of progress and changes.
  - Create Communication Platforms: Utilize collaboration tools such as Slack, Microsoft Teams, Confluence, or Trello to facilitate ongoing and transparent communication among stakeholders.

- Conduct Regular Feedback Sessions: Organize regular feedback sessions (weekly, bi-weekly, or monthly as appropriate) to gather input from stakeholders, address concerns, and adjust strategies as needed.

- **Motivate Stakeholder Investment:**
  - Define Clear Objectives: Develop and share specific, measurable, achievable, relevant, and time-bound (S.M.A.R.T.)[35] goals with stakeholders to align efforts and expectations.

  - Implement Incentive Programs: Establish incentive programs that reward stakeholders for meeting or exceeding targets through recognition, additional resources or other tailored incentives.

  - Host Collaborative Workshops: Organize workshops and training sessions to help stakeholders understand their roles and the overall vision, fostering a sense of ownership and investment.

- **Cultivate a Trustworthy and Reliable Environment:**
  - Demonstrate Consistency: Ensure decisions and actions remain transparent and predictable, building credibility and trust.

  - Showcase Success Stories: Regularly examples such as share case studies and success stories that highlight the tangible benefits and returns from collaborative efforts to maintain confidence.

[35] George T. Doran, "There's a S.M.A.R.T. Way to Write Management's Goals and Objectives," *Management Review* 70, no. 11 (1981): 35–36

- Maintain Open Channels for Concerns: Provide clear and accessible channels for stakeholders to voice concerns and provide feedback, ensuring their issues are addressed timely and transparently.

- **Uphold High Stakeholder Engagement:**
  - Engage Through Interactive Activities: Organize regular interactive activities such as brainstorming sessions, hackathons, and innovation challenges to keep stakeholders actively involved.

  - Establish Engagement Metrics: Develop metrics to track stakeholder engagement levels, such as participation rates in meetings and collaborative projects, and use this data to improve strategies. Periodically assess the level of stakeholder commitment through surveys and interviews and take action to address any issues identified.

  - Celebrate Milestones Together: Host events to celebrate project milestones and achievements, fostering a sense of community and shared success among stakeholders.

- **Elevate Goals and Achieve Excellence:**
  - Set Monthly or Quarterly Targets: Break down long-term goals into monthly or quarterly targets that are meaningful yet manageable, and review progress regularly.

  - Provide Resource Support: Ensure stakeholders have access to the necessary tools, training, and resources, such as funding, technology, and expert consultations, to meet elevated expectations.

- Encourage Peer Learning: Facilitate peer learning opportunities where stakeholders can share knowledge and best practices, inspiring each other to reach higher standards.

- **Build Relational Contracts:**
  - Facilitate Joint Problem-Solving:
    - *Building Task and Relational Knowledge*: Joint problem-solving fosters a shared understanding of each stakeholder's goals, duties, capabilities, and constraints. This can reduce misunderstandings and allow stakeholders to adapt to changing circumstances and new information.
    - *Strengthening Reciprocity:* Collaborative problem-solving builds goodwill as well as reinforces mutual trust and reciprocity.

  - Develop Clear Documentation:
    - *Reducing Ambiguity:* While relational contracts are informal, clear documentation of roles and expectations provides a reference point for shared understanding, thereby reducing potential for conflict.
    - *Enabling Flexibility*: Documentation can serve as a framework that allows for renegotiation and adaptation as relationships evolve.

  - Organize Cross-Functional Teams:
    - *Enhancing Collaborative Capacity*: Cross-functional teams encourage diverse stakeholders to work together, deepening their understanding of one another's contributions and strengths.
    - *Building Relational Capital:* Repeated interactions in cross-functional settings can foster trust and relational capital, both of which are beneficial for strengthening relational contracts.

- **Strengthen Commitment to Agreements:**
  - Align Values and Goals: Ensure that the organization's values and goals are clearly communicated and aligned with those of the stakeholders to build loyalty and dedication.

  - Provide Ongoing Training: Offer continuous development opportunities to reinforce both performance and long-term commitment.

- **Manage Disruptions Proactively:**
  - Develop Risk Management Plans: Create comprehensive risk management plans that include strategies for maintaining engagement and communication during disruptions.

  - Establish a Rapid Response Team: Empower a dedicated group to restore stakeholder confidence quickly when unexpected issues arise.

  - Communicate Contingency Plans: Clearly communicate contingency plans to all stakeholders, ensuring they know how disruptions will be managed and what their roles will be in response.

Trust and Relational Contracts

Beginning with a simple stock-and-flow representation, Figure 4.0 models Institutional Trust as a *stock*, an accumulation that reflects the current level of trust. This stock is shaped by the balance between *trust-building* actions (inflows) and *trust-depleting* actions (outflows). For a more detailed analysis and illustration of these mechanisms, see the *Comprehensive Institutional Trust Model* in Appendix, Table 6, which also shows how trust interacts with the dynamics and *effectiveness of relational contracts*.

The key insight is that when trust-building actions consistently outweigh trust-depleting events, institutional trust accumulates, reinforcing a stable and resilient environment. Conversely, when trust-depleting actions surpass trust-building efforts, institutional trust erodes over time, placing relationships and cooperation within the ecosystem at risk.

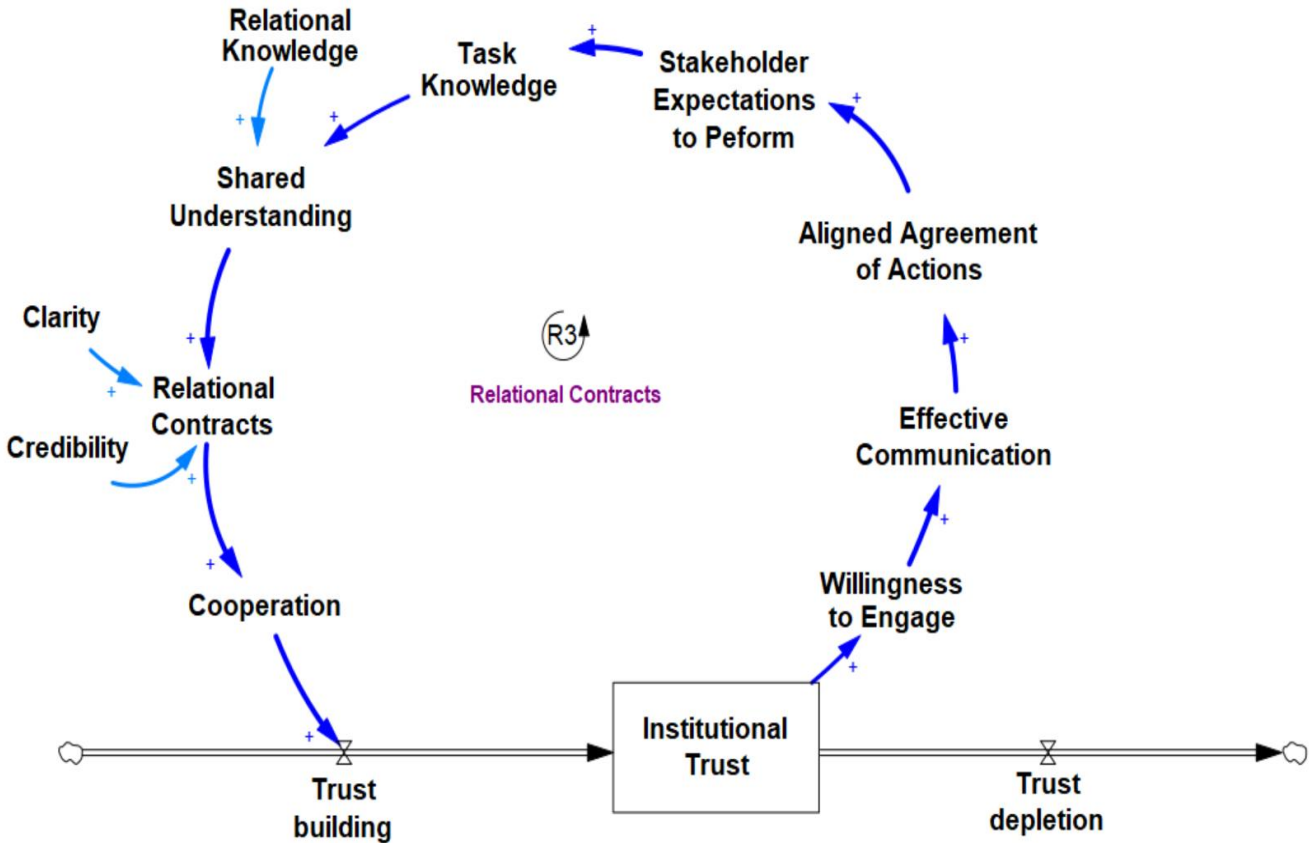


Figure 4.0 – Simple Stock-and-Flow Diagram of Institutional Trust

In summary, trust is essential for increasing stakeholders' *willingness to engage,* enabling *effective communication*, and ultimately supporting the development of strong *relational contracts*. The benefits of trust on relational contract effectiveness are tempered by a natural time **delay** because trust functions like a reservoir—it is a stock within the system that can only build gradually over time. It cannot be filled instantly; instead, it requires consistent actions such as attending meetings, following through on commitments, and sharing resources to raise the "water level" of confidence. Only once this reservoir reaches a sufficient level do stakeholders feel secure enough to enter into more ambitious agreements and rely more deeply on one another. This explains why improvements in relational contract effectiveness are not immediate but instead follow the gradual accumulation of trust. As trust deepens, relational contracts grow more effective, which in turn encourages further trust-building behaviors, creating a reinforcing loop that steadily strengthens the network of relationships.

As noted, the *Comprehensive Institutional Trust Model* diagram in Appendix Table 6 expands on this dynamic by incorporating additional variables and balancing feedback loops that influence both the accumulation and depletion of trust. These mechanisms are crucial for fostering cooperation and collaboration across diverse stakeholders. The comprehensive model also demonstrates how trust and relational contract effectiveness interact, leading to key implications and recommendations outlined below.

Implications and Recommendations for Managing Trust & Relational Contracts

Implications:

- **Trust-Building Takes Time and Effort:** Trust-building among stakeholders (e.g., government, universities, entrepreneurs, etc.) is a gradual process that involves a *Delay* as trust is slowly earned through effective communication and consistent, reliable actions. Understanding this delay is crucial, highlighting that stakeholders must be patient and persistent in their efforts to build trust. While some initial trust may exist at the outset, further delays in establishing deeper trust can occur as stakeholders work toward aligning agreements and developing

a shared understanding, which is a critical foundation for forming effective relational contracts.

    - At first, trust-building helps manage the delays that impact relational contract effectiveness. However, if delays become prolonged and frequent, they can reduce relational contract effectiveness, ultimately weakening relational contracts and leading to decreased cooperation and performance.

    - Thus, this creates a two-pronged impact: while trust initially helps mitigate delays, persistent delays can undermine relational contract effectiveness, making it harder to maintain high performance and stable relationships among stakeholders.

- **The Significance of Trust-Building in Relational Contracts**: Relational contracts are “informal agreements sustained by the shadow of the future".[36] It depends on the Shared Understandings that are developed and reinforced by the belief that parties will continue to interact over time.

    - Initial trust-building encourages a *willingness to engage* and supports *effective communication*. As stakeholders strive to meet expectations, they should align on *task knowledge* and *relational knowledge*, creating a foundation of *shared understanding*. This shared understanding is crucial for establishing Relational Contracts, which are further supported by clarity and credibility. Together, these factors promote *cooperation* and allow these informal agreements to work effectively. This cycle of trust-building and cooperation continues to strengthen trust within the system and foster a stable, collaborative environment.

[36] Robert Gibbons and Rebecca Henderson, "Relational Contracts and Organizational Capabilities," Organization Science 23, no. 5 (2012): 1350–1364.

- **Vulnerability to Trust Depletion**: Negative actions such as *fraud, contract breaches, project failures, unwillingness to engage* and *ineffective communication* can erode trust. If such issues are not promptly addressed, the ecosystem is vulnerable to instability.

- **Critical Role of Communication and Engagement:** *Effective communication* and high levels of stakeholder *engagement* are essential for aligning goals and actions and maintaining institutional trust. Breakdowns in these areas can lead to significant depletion of trust.

Recommendations from the Institutional Trust Model Insights:

- **Cultivate a Culture of Integrity:**
  - Model honesty, transparency, and reliability at all levels by setting clear expectations and reinforcing them through regular check-ins and open communication channels. Recognize individuals who consistently demonstrate accountability.

  - Co-create and enforce clear ethical guidelines (e.g., a regional Business Code of Conduct or Ethics Code). Provide training and resources to ensure integrity is not only understood but embedded as a core cultural value.

- **Invest in Relationship Currency:**
  - Create regular opportunities for stakeholders to build relational knowledge through shared experiences, what-if simulations, feedback sessions, and knowledge-sharing activities.

- Use these interactions to strengthen mutual understanding by clarifying strengths, responsibilities, and approaches to problem-solving. Incorporate scenario planning and joint exercises to deepen cooperation, trust, and goal alignment.

- **Promote Accountability and Adherence to Agreements:**
  - Establish a system for tracking and regularly reviewing agreements to ensure all parties consistently meet their commitments. Schedule periodic check-ins with stakeholders to monitor progress, address any issues early, and reaffirm shared expectations.

  - Implement monitoring and audit systems to detect potential breaches early, paired with transparent reviews of key processes.

  - Communicate consequences for contract violations clearly and enforce them consistently. Provide compliance training to ensure all stakeholders understand expectations and responsibilities.

- **Boost Transparency and Engagement**:
  - Publish clear, accurate progress reports at regular intervals to strengthen credibility and trust.

  - Actively involve stakeholders in key decision-making processes by inviting their input, holding collaborative discussions, and ensuring they feel valued in shaping outcomes. Encourage open communication channels where stakeholders can ask questions and provide feedback, fostering a culture of transparency and high engagement.

Conclusion

This study underscores the essential role of trust-building and its interplay with relational contracts in fostering thriving ecosystems for ‘innovation-driven enterprises’ (IDEs). Beginning with MIT’s iEcosystem framework and the REAP five-stakeholder model, the analysis examined how regional innovation ecosystems can be assessed and strengthened. Using the REAP Madrid Case Study as a success story, system dynamics modeling revealed how stakeholder *communication, agreements, cooperation, and partnerships* are leverage points that generate reinforcing feedback loops that can accelerate ecosystem growth.

The model titled *The Causal Relationships of Trust* (causal loop diagram, CLD) extended these insights by illustrating how trust operates as a dynamic mechanism of *cooperation, agreement,* and *shared understanding*, represented in the key reinforcing loops (R1–R3). Importantly, the CLD also highlighted that trust is vulnerable: when actual performance falls short of expectations, the loops can be disrupted, weakening *engagement, communication,* and *agreements*. These findings emphasize both the generative and fragile nature of trust, underscoring its pivotal role in innovation ecosystem performance.

Building on this, the *Comprehensive Institutional Trust Model* uses a stock-and-flow perspective to frame trust as an accumulation that grows through consistent, repeated actions and diminishes when commitments are broken. This perspective also highlights the presence of a time **delay**: improvements in relational contract effectiveness do not occur instantly, but when trust reaches an adequate level. Ultimately, the analysis in this study indicates that trust may serve as the hidden infrastructure underpinning collaboration and relational contracts within innovation ecosystems, aligning with the initial hypothesis of this paper. Because trust builds gradually yet provides foundation for some stability, iEcosystems with deeper reservoirs of trust are better equipped to navigate uncertainty, withstand disruption, and generate long-term growth.

Future research should expand this modeling by exploring deeper interactions between trust and relational contracts, including the impact of time delays. Additional case studies could be analyzed and simulated using this framework to validate its robustness across varied contexts. Such work would further reveal how different factors interact to shape ecosystem resilience, offering actionable insights for policymakers, stakeholders, and ecosystem leaders.

In closing, this study shows that trust is not merely a social virtue but a structural variable that determines whether iEcosystems flourish or falter. Understanding and leveraging the dynamics of trust and relational contracts will be pivotal to building regional innovation ecosystems that are vibrant, adaptive, and capable of driving long-term economic growth.

Appendix

Table 1: System Dynamics Methodology Description

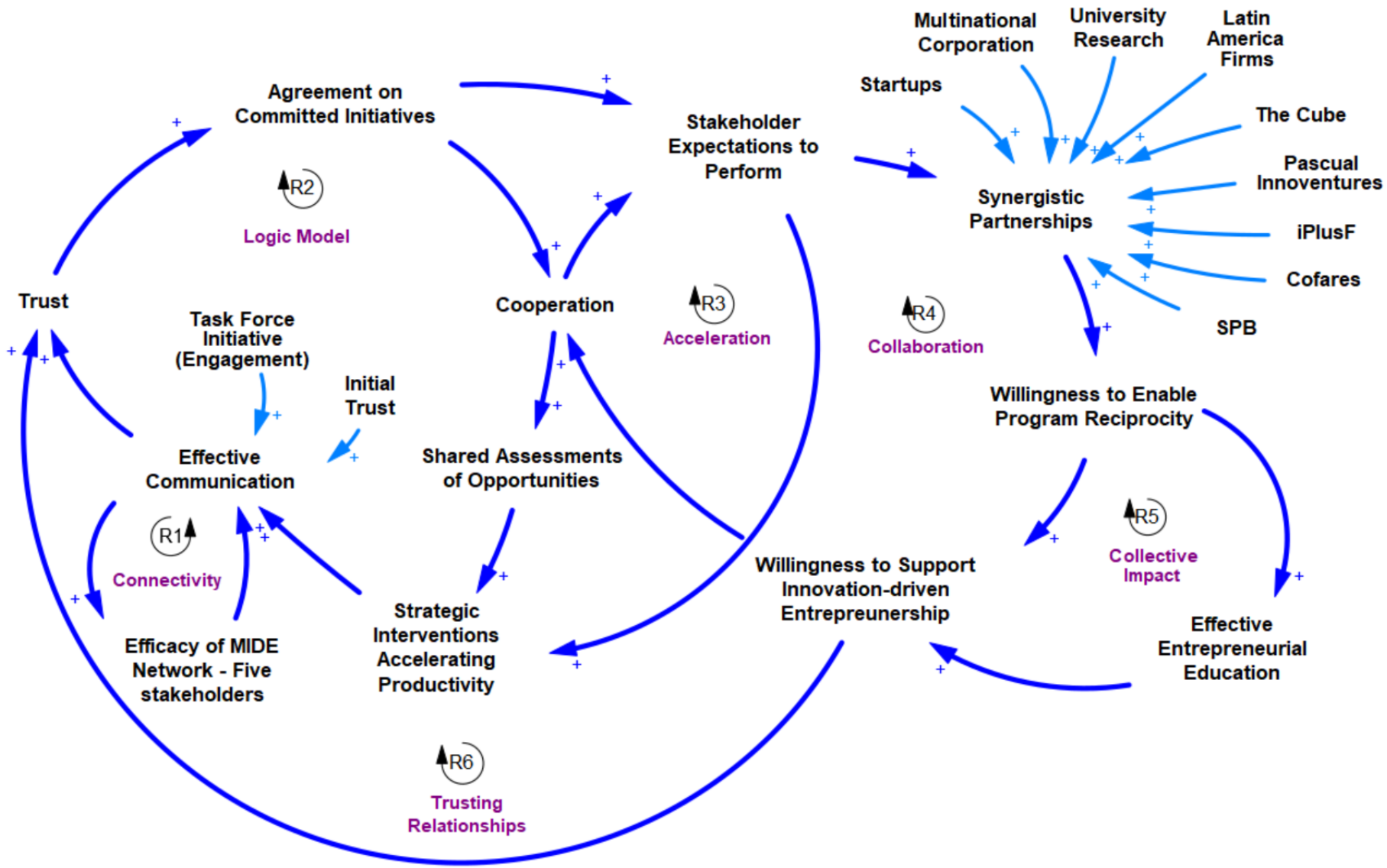
System Dynamics	
Concept	**Description**
System Dynamics Modeling	System Dynamics is a powerful analytical methodology for understanding and managing complex systems characterized by interdependent components and feedback loops. Developed by Jay Forrester in the 1950s, it has become an essential tool in fields such as economics, environmental science, engineering, and organizational management.[37] This working paper integrates the core concepts of System Dynamics because it offers a robust framework for analyzing and managing complex systems by focusing on the interplay of stocks, flows, and feedback loops—reinforcing and balancing loops. Stocks provide a snapshot of the system's state, while flows drive changes within the system. Causal Loop Diagrams help visualize the relationships between variables, revealing the presence of reinforcing and balancing loops. Understanding these core concepts allows practitioners to predict system behaviors, identify potential issues, and design effective interventions to achieve desired outcomes. By leveraging the principles of System Dynamics, we can better understand the complexities of innovative and entrepreneurial ecosystems or RIE.
Stocks and Flows	Stocks are the foundational elements of System Dynamics models. They represent the quantities or accumulations of resources, information, or material within a system at any given time. Stocks can

[37] System Dynamics Society. "Origin of System Dynamics." Accessed May 2024. https://systemdynamics.org/origin-of-system-dynamics/.

	be thought of as reservoirs that increase or decrease based on the system's dynamics. Flows are the processes that alter the levels of stocks. They are the rates at which resources move into or out of stocks, essentially driving changes within the system. Flows are crucial because they determine how stocks evolve over time, influencing the system's behavior and trajectory.
Causal Loop Diagrams (CLDs)	Causal Loop Diagrams "are an important tool for representing the feedback structure of systems."[38] visual tools are used to map out the relationships between different variables within a system. "Variables are related by *causal links*,"[39] connected by arrows that indicate the direction of causality. Each arrow is annotated with a polarity with a plus (+) or minus (−) sign to show whether the relationship is positive (the variables move in the same direction) or negative (the variables move in opposite directions). CLDs help identify feedback loops, which are critical in understanding how systems evolve and respond to changes.
Reinforcing and Balancing Loops	Reinforcing loops (R) are feedback loops that amplify change within a system. These loops can lead to exponential growth or decline, as each iteration of the loop strengthens the previous effect. This positive feedback creates a self-reinforcing cycle of growth. While reinforcing loops can drive rapid progress, they can also lead to runaway problems if not properly managed. Balancing loops (B) are feedback loops that counteract change, striving to bring the system to a desired state or equilibrium. These loops work to stabilize the system by opposing the direction of change. Balancing loops is essential for maintaining stability and preventing systems from veering too far off course.[40]

[38] Sterman, "Business Dynamics," chap. 5.
[39] Sterman, "Business Dynamics," chap. 5.
[40] Sterman, "Business Dynamics," Thinking," chap. 1-6.

Table 2: Madrid Case Full Casual Loop Diagram



Madrid's Success Story

Summary of Diagram Loops

In this diagram, **Initial Trust** is the catalyst for building **Effective Communication** within the **Task Force Initiative (Engagement)**, as shown in **Reinforcing Loop R1 (Connectivity)**. This foundational trust enables transparent interactions, leading to **Agreement on Committed Initiatives** and **Stakeholder Expectations to Perform**. These actions foster **Cooperation** and **Shared Assessments of Opportunities** within **Reinforcing Loop R2 (Logic Model)**, boosting the **Efficacy of the MIDE Network**.

This initial trust triggers further positive feedback loops, such as **R3 (Acceleration)**, **R4 (Collaboration)**, **R5 (Collective Impact)**, and **R6 (Trusting Relationships)**, which enhance **Program Reciprocity**, **Support for Innovation-driven Entrepreneurship,** and further strengthens **Trust**.

Notably, the **Initial Trust** is essential for initiating a series of reinforcing cycles that create a stable, trust-based collaborative ecosystem. Without any **Initial Trust** to kickstart this process, the cycle would struggle to gain momentum, as stakeholders may approach interactions with hesitation or skepticism, leading to ineffective communication and potentially a disconnected network. By setting a positive initial tone, **Initial Trust** effectively creates a self-reinforcing cycle that supports ongoing collaboration, engagement, and productivity.

About the Diagrams:

This causal loop diagram captures the success story of REAP Madrid, drawing from the case study by Professors Scott Stern and Fiona Murray et al. in "Accelerating Innovation Ecosystems: The Promise and Challenges of Regional Innovation Engines." The model aligns closely with their analysis and is scoped to the context and findings presented therein. Both David Márquez, CEO and Director General at MIDE, and Álvaro Bernad, former CEO at MIDE, also provided additional insights that deepened the understanding of how trust, connectivity, collaboration, and stakeholder alignment shaped Madrid's innovation ecosystem.

Furthermore, a separate diagram in Table 4 of this Appendix specifically illustrates the scenario of trust erosion and the resulting downward spiral (vicious cycle), demonstrating the potential compounding effects within the system. Trust can either accumulate or erode based on interactions and behaviors with stakeholders.

Table 3: Madrid Case: Variables and Description

"Connectivity" - Reinforcing Loop 1 (R1)	
Variable	**Description**
Task Force Initiative (Engagement)	A multi-year task force composed of leaders from all five stakeholder groups (universities, entrepreneurs, risk capital providers, corporations, and government) identified specific opportunities and bottlenecks within their respective domains, ultimately designing and implementing a Madrid-specific approach to ecosystem development. As communication improved, stakeholders became more willing to engage actively in these task force initiatives. These initiatives served as structured engagements through which stakeholders collaborated on targeted projects and shared objectives, reinforcing both their mutual commitment and the overall cohesion of the ecosystem.
Initial Trust	The loop begins with the formation of initial trust among stakeholders and serves as a key element that enables open communication and cooperation. Initial trust reflects the baseline level of confidence and goodwill at the beginning of collaboration, often built on prior relationships, institutional reputation, or shared objectives before formal projects begin. This early confidence serves as the catalyst that activates communication, connectivity, and cooperation across the ecosystem.
Effective Communication	As initial trust is established, it fosters more open and effective stakeholder communication. Effective communication goes beyond information exchange. It ensures clarity of purpose, transparency in decision-making, and mutual understanding of roles and expectations. When stakeholders communicate consistently and authentically, they align goals, reduce misunderstandings, and reinforce the trust that enables deeper connection and collaboration across the ecosystem.
Efficacy of MIDE (Madrid Innovation Driven Entrepreneurship) Network - Five Stakeholders	The Inital trust and engagement through task force initiatives strengthens the efficacy of the "MIDE" network – the five key stakeholders in the ecosystem, including universities, entrepreneurs, risk capital providers, corporations, and government institutions. A robust network signifies stronger interconnections and synergies among these entities.

"Logic Model" - Reinforcing Loop 2 (R2)	
Variable	**Description**
Effective Communication	Effective communication among stakeholders is the starting point of this loop. It fosters a shared understanding and aligns the interests of different parties involved.
Trust	A collective expectation that organizations will honor agreements, act transparently, and uphold shared norms, fostering cooperation and resource exchange among stakeholders.
Agreement on Committed Initiatives	Enhanced cooperation leads to broader agreement on goals, strategies, and the distribution of resources. When stakeholders agree on the way forward, it builds a stronger foundation for sustained collaboration.
Cooperation	The insights gained from assessments help to enhance cooperation among stakeholders. When stakeholders see tangible results from their collaborative efforts, they are more likely to continue working together and support each other's initiatives.
Shared Assessments of Opportunities	Shared assessments are conducted to identify opportunities and evaluate their effectiveness. These assessments provide critical feedback and insights into what is working and what needs adjustment.
Strategic Interventions Accelerating Productivity	Improved communication enables stakeholders to identify and implement strategic interventions that can accelerate productivity. These interventions are targeted actions or policies designed to address specific challenges or leverage opportunities within the ecosystem. The four strategic interventions include: 1) Commercialization & Acceleration Programs 2) Human Capital and Workforce Development 3) Innovation Partnerships 4) Investment and Risk Capital

"Acceleration" - Reinforcing Loop 3 (R3)	
Variable	**Description**
Effective Communication	Effective communication among stakeholders is the initial step in this loop. It facilitates the exchange of information, ideas, and feedback, creating a foundation of mutual shared understanding and alignment.
Agreement on Committed Initiatives	Improved communication helps stakeholders reach agreements on goals, strategies, and actions. When stakeholders communicate effectively, they can align their interests and come to mutually beneficial agreements more easily.
Stakeholder Expectations to Perform	Reaching agreements raises the expectations of stakeholder to perform. High expectations act as a driving force, motivating stakeholders to aim for higher performance and greater outcomes.
Strategic Interventions Accelerating Productivity	With heightened expectations, stakeholders are encouraged to engage in more impactful strategic interventions. These interventions are targeted actions designed to address specific challenges or leverage opportunities within the ecosystem.

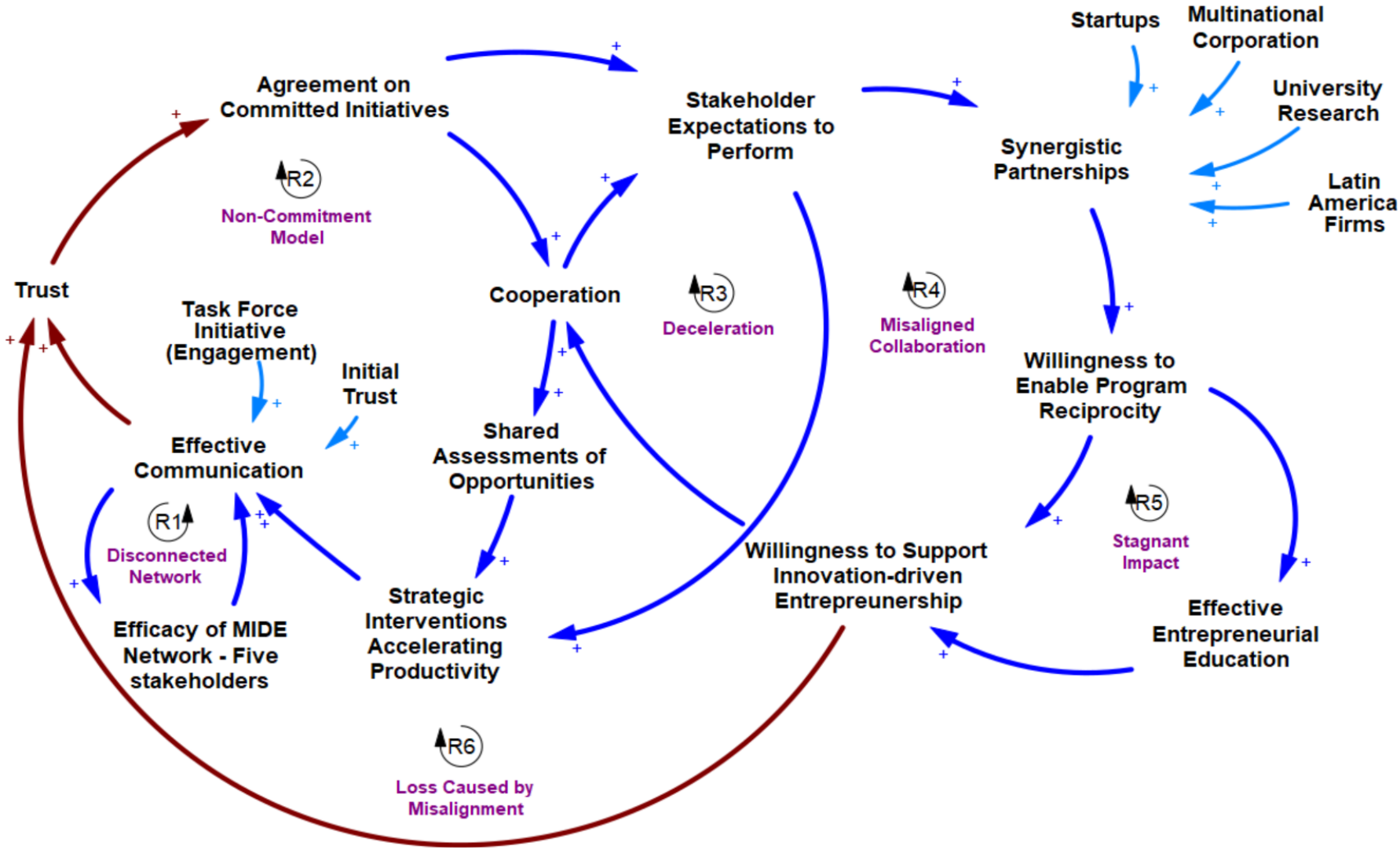
"Collaboration" - Reinforcing Loop 4 (R4)	
Variable	**Description**
Cooperation	The loop begins with cooperation among stakeholders. Effective cooperation allows these stakeholders to work together, share resources, and align their efforts toward common goals.
Shared Expectations to Perform	As cooperation increases, so do the expectations of stakeholders to perform.. They begin to anticipate better outcomes from their collaborative efforts, which motivates them to invest more time and resources into the ecosystem. In Madrid, the success of early cooperative efforts raised expectations for what the ecosystem could achieve, encouraging further collaboration.
Synergistic Partnerships	Higher expectations lead to the formation of robust partnerships. In Madrid, these partnerships included various combinations of startups, multinational corporations, university research groups, Latin American firms, and ecosystem accelerators such as The Cube, Pascual Innoventures, iPlusF, Cofares, SPB, etc. These partnerships leverage the unique strengths of each stakeholder to create synergies that drive innovation.
Willingness to Enable Program Reciprocity	Strong partnerships enhance program reciprocity, where stakeholders mutually benefit from each other's resources and capabilities. Madrid's initiative to connect startups with multinational corporations provided mutual benefits—startups gained access to resources and markets, while multinationals tapped into new innovations and entrepreneurial talent.
Willingness to Support Innovation-driven Entrepreneurship	Increased program reciprocity fosters the willingness to support innovation-driven entrepreneurship. In Madrid, this manifests through initiatives like the Madrid Innovation Driven Entrepreneurship (MIDE) network, which is specifically focused on start-ups that could benefit from partnerships with multinationals and connections to Latin America.

"Collective Impact" - Reinforcing Loop 5 (R5)	
Variable	**Description**
Cooperation	The loop begins with cooperation among stakeholders. Effective cooperation facilitates sharing resources and aligning efforts towards common goals, creating a foundation for further collaborative activities.
Shareholder Expectations to Perform	Increased cooperation raises stakeholders' expectations for successful outcomes. Higher expectations motivate stakeholders to invest more resources and effort into their collaborative initiatives, believing that their collective actions will yield significant benefits.
Synergistic Partnerships	Elevated expectations lead to the formation of robust partnerships. These partnerships, involving startups, multinational corporations, university research groups, and Latin American firms, leverage the unique strengths of each stakeholder. These collaborations create synergies that drive innovation.
Willingness to Enable Program Reciprocity	Strong partnerships enhance program reciprocity, where stakeholders mutually benefit from each other's resources and capabilities. Initiatives like the Madrid Innovation Driven Entrepreneurship (MIDE) network facilitate these connections, fostering a collaborative environment where all parties gain value from their interactions.
Effective Entrepreneurial Education	Enhanced program reciprocity supports more effective entrepreneurial education. As stakeholders engage in reciprocal programs, they share knowledge and best practices, which help to build a culture of entrepreneurship. Culture and incentives are crucial because they shape the regional supply of human capital through migration.
Willingness to Support Innovation-driven Entrepreneurship	Effective entrepreneurial education fosters the willingness to support innovation-driven entrepreneurship. As more individuals and organizations embrace an entrepreneurial mindset, the ecosystem becomes more dynamic and innovative. This increase in entrepreneurial activity further strengthens the cooperative spirit among stakeholders.

"Trusting Relationships" - Reinforcing Loop 6 (R6)	
Variable	**Description**
Trust	The shared confidence in organizations' reliability, competence, and integrity, enabling stakeholders to collaborate with reduced risk and greater commitment to common goals.
Agreement on Committed Initiatives	Following trust, stakeholders translate mutual confidence into concrete commitments. They would define initiatives, roles, resources, and timelines with the expectation that each party will follow through.
Shareholder Expectations to Perform	The collective belief among ecosystem stakeholders about the level of performance that can and should be achieved in delivering agreed initiatives. These expectations are shaped by the *Agreement of Committed Initiatives* and reinforced through trust, as stakeholders anticipate that others will honor their commitments.
Synergistic Partnerships	High stakeholder expectations catalyze the creation of robust partnerships that unite startups, multinational corporations, university research groups, Latin American firms, and ecosystem accelerators such as The Cube, Pascual Innoventures, iPlusF, Cofares, SPB, etc. By combining their distinct strengths, these collaborations generate synergies that accelerate innovation and amplify the ecosystem's collective impact.
Willingness to Enable Program Reciprocity	Strong partnerships foster a readiness among stakeholders to engage in reciprocal programs that deliver mutual benefits. By sharing resources, expertise, and capabilities, stakeholders create a collaborative environment where all parties gain value from their interactions. Initiatives such as the Madrid Innovation Driven Entrepreneurship (MIDE) network exemplify this dynamic, connecting diverse actors and reinforcing a culture of mutual support.
Effective Entrepreneurial Education	Enhanced program reciprocity strengthens entrepreneurial education by enabling stakeholders to exchange knowledge, best practices, and experience. These interactions build a culture of entrepreneurship, equip participants with the skills and mindset needed to innovate, and create incentives that attract and retain talent. This can shape the regional supply of human capital and support long-term ecosystem growth.

Willingness to Support Innovation-driven Entrepreneurship	Effective entrepreneurial education fosters an entrepreneurial mindset that motivates stakeholders to actively support innovation-driven ventures through collaboration, advocacy, and resource sharing. This true willingness to act, shared alignment, and follow through on commitments strengthens trust, reinforcing cooperative relationships and enhancing the ecosystem's capacity for growth and innovation.

Table 4: The Downward Spiral of Trust Loss



The Downward Spiral of Trust Loss

Summary of Diagram Loops

The diagram titled "The Downward Spiral of Trust Loss" illustrates how the breakdown of trust initiates a self-reinforcing, **vicious cycle** within an innovation ecosystem. The diagram highlights key feedback loops that drive this downward spiral, illustrating how a loss of trust disrupts key relationships, communication, and collaboration among stakeholders, which in turn decelerates innovation and entrepreneurial efforts. Starting with an initial loss of trust, the cycle intensifies as further interactions compound the erosion, ultimately affecting the ecosystem's health.

Conversely, when trust is actively cultivated through strong communication and engagement, it initiates a virtuous cycle. This cycle builds positive momentum that benefits the entire ecosystem.

Breakdown of the Reinforcing Feedback Loops:

- **R1 – "Disconnected Network":**
  - Effective communication fosters a shared understanding and aligns the interests of different parties involved. Loss of initial trust leads to a reduction in effective communication between stakeholders. This results in lower involvement from key actors (e.g., start-ups, universities, corporations), further diminishing the efficacy of the network.
  - As communication breaks down, the initial trust that fosters collaboration deteriorates, leading to a weaker foundation for future engagement and trust-building efforts. This reinforcing loop accelerates the erosion of trust, further isolating stakeholders and creating a disconnected network.

- **R2 – "Non-Commitment Model":**
  - As trust decreases, the agreement on committed initiatives weakens, creating a scenario where stakeholders are less likely to follow through on commitments. This lack of commitment reduces the ability to form stable, long-term collaborations, which are essential for maintaining innovation ecosystems.
  - The reduced commitment leads to unmet stakeholder expectations, resulting in diminished cooperation, further accelerating the erosion of trust and reinforcing the non-commitment model.

- **R3 – "Deceleration":**
  - Stakeholder expectations to perform begin to decline as trust is lost, leading to reduced cooperation and lower engagement in shared assessments of

The Downward Spiral of Trust Loss

Summary of Diagram Loops

opportunities. This decelerates the momentum for innovation, reducing the ecosystem's overall productivity.
    - This loop further reinforces the cycle of trust loss by stalling the key mechanisms that drive shared opportunities and collaboration.

- **R4 – "Misaligned Collaboration":**
    - Misalignment among stakeholders grows as trust is lost. Misalignment disrupts synergistic partnerships, weakening collaborative efforts that drive innovation and entrepreneurial programs.
    - As stakeholders become increasingly misaligned, partnerships become less effective, further stifling the ecosystem's innovation capacity and reinforcing the misalignment.

- **R5 – "Stagnant Impact":**
    - Willingness to enable program reciprocity diminishes as trust continues to erode. Without trust, stakeholders are less likely to support cross-organizational programs, leading to a stagnant impact where entrepreneurial education and innovative initiatives fail to adapt to new opportunities.
    - The stagnation reinforces itself as the entrepreneurial culture becomes unresponsive to external stimuli, preventing new initiatives from flourishing and accelerating the loss of trust.

- **R6 – "Loss Caused by Misalignment":**
    - Misalignment between stakeholders not only causes cooperation to weaken but also introduces inefficiencies in strategic interventions, programs, and overall efforts. As misalignment worsens, the ecosystem's ability to implement effective interventions and accelerate productivity diminishes, reinforcing the loop where misalignment further contributes to trust loss and system inefficiency.

Table 5: Trust Casual Loop Diagram Variables and Description

"Cooperation" - Reinforcing Loop 1 (R1)	
Variable	**Description**
Effective Communication	Effective Communication is the starting point of the Cooperation loop. It involves the exchange of information, ideas, and feedback among stakeholders.
Aligned Agreement of Actions	Through effective communication, stakeholders reach aligned agreements on goals, strategies, and actions to be taken.
Stakeholder Expectations to Perform	Once agreements are in place, they set the expectations of the stakeholders to perform. These expectations pertain to the anticipated outcomes and benefits of their collaborative efforts.
Effective Performance	As stakeholders work together in alignment with their agreements and expectations, their collective performance improves.
Achieving Returns **Actuals > Expected:** **("Cooperation" Loop)**	The diagram labeled Figure 3.0 illustrates the Cooperation Loop, formed when actual returns meet or exceed expectations. **Reinforcing Loop (R): When Actuals Returns > Expected Returns** When the performance meets or exceeds the agreed-upon expectations, stakeholders experience the achievements on their investments of time, effort, and resources. In system dynamics terms, the same structure can generate reinforcing or balancing behavior depending on whether actual results exceed or fall short of expectations. Hence, behavior of the loop depends on the relationship between *Actual Returns* and *Expected Returns*. • **When Actuals > Expected:** All causal links in the loop are positive, meaning each variable amplifies the next. This creates a **Reinforcing Loop (R)**, where success builds on success and stakeholder confidence, engagement, and performance continue to grow.

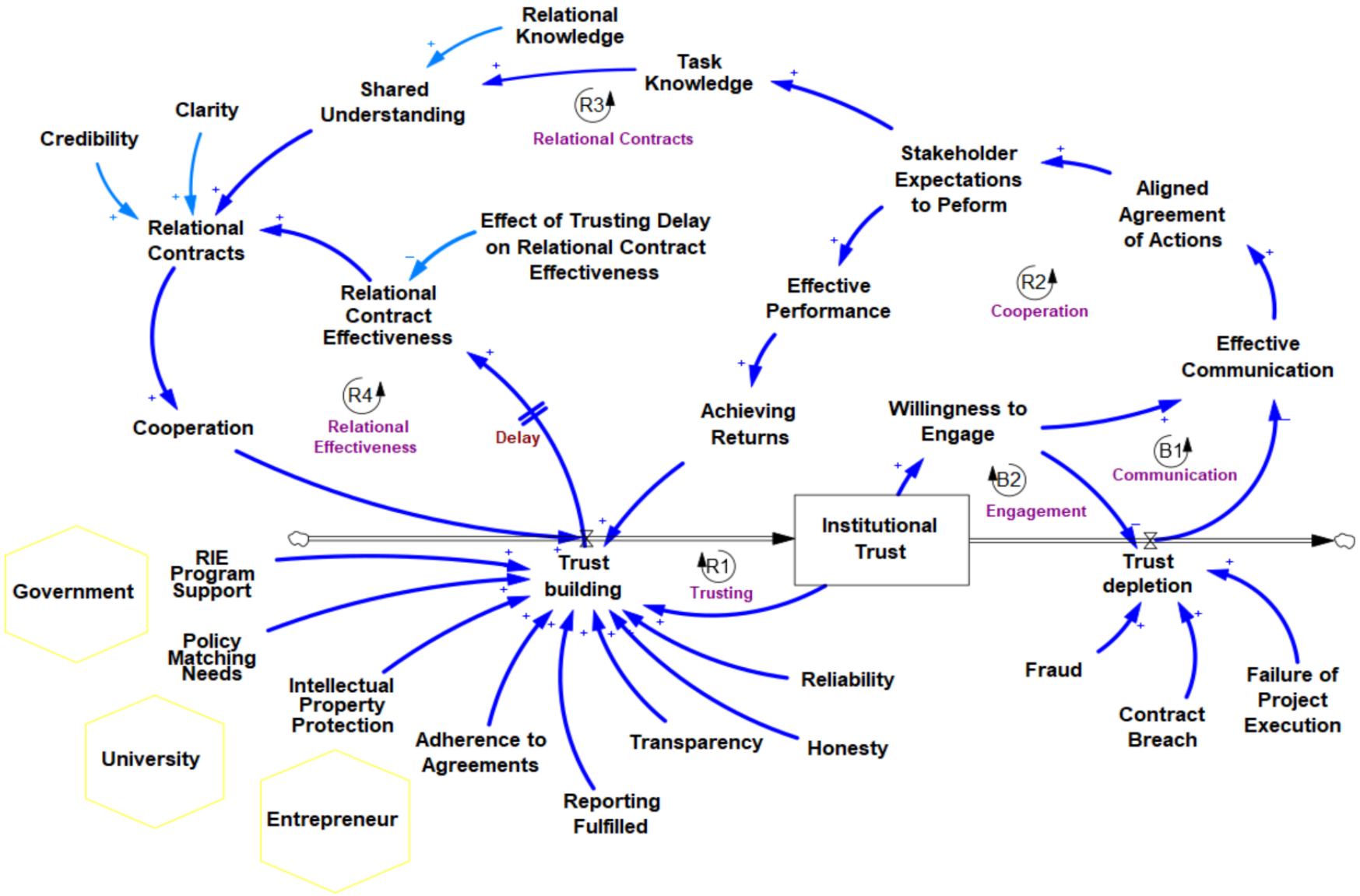
	• **When Actuals < Expected:** The gap becomes negative, flipping the loop into a **Balancing Loop (B)**. In this case, weaker performance lowers engagement, communication, and expectations, which pushes the system to self-correct.
Achieving Returns **Actuals < Expected** **(“Collapse” Loop)**	The diagram labeled Figure 3.1 illustrates the Collapse Loop, formed when actual returns fall below expectations. **Balancing Loop (B): When Actuals Returns < Expected Returns** When actual returns fall below expectations, the loop shifts into a balancing mode. Lower performance reduces engagement, weakens communication, and lowers expectations, which together temper further decline. This self-correcting effect constrains growth. Not achieving expected returns that were established in the agreements with the other stakeholders, however, can destabilize the system and serve as the initial point of disruption. Deviations between actual and expected outcomes create uncertainty and can erode stakeholders’ confidence in established processes and strategies. This misalignment often leads to reduced engagement, as stakeholders’ motivation and trust in the system are compromised.
Willingness to Engage	The realization of achieving returns leads to increased engagement among stakeholders, thus, could enhance communication quality. Seeing the benefits of cooperation motivates stakeholders to remain actively involved in the ecosystem.

"Agreement" - Reinforcing Loop 2 (R2)	
Variable	**Description**
Maintaining Integrity	Maintiaing Integrity is the foundational variable that feeds into Effective Performance. It involves adherence to moral, and ethical principles, fostering an environment of honesty, trustoworthiness, and reliability.
Effective Performance	Maintaining Integrity and Effective Performance fosters a trustworthy environment where stakeholders are motivated to work effectively and could produce better results. When stakeholders act with integrity, their actions are consistent and reliable, reducing misunderstandings and conflicts.
Stakeholder Expectations to Perform	As performance improves, it raises the expectations of stakeholders. When stakeholders see that their cooperative efforts lead to successful outcomes, their expectations for future performance increase.

"Understanding" - Reinforcing Loop 3 (R3)	
Variable	**Description**
Stakeholder Expecations to Perform	Stakeholder expectations of performance set the standard for what stakeholders aim to achieve. These expectations to perform motivate stakeholders to acquire and apply the necessary knowledge and skills to meet these goals.
Task Knowledge	Enhanced task knowledge contributes to a shared understanding among stakeholders. When everyone knows what needs to be done and what they're supposed to do, collaboration becomes more effective and efficient.
Shared Understanding	Shared understanding involves developing task knowledge and relational knowledge. It also requires a mutual comprehension of roles, goals, and processes.

Relational Knowledge	Communication to gain mutual understanding of the actions, payoffs, and consequences for the stakeholders if a promise is broken could strengthen connections and effective collaboration.
Willingness to Commit to Agreement	This refers to the willingness of stakeholders to commit to the agreements such as institution's goals, actions, and values. It involves a collective sense of responsibility and dedication. High willingness to commit drives improved performance, as stakeholders are motivated to work diligently and support each other in achieving common goals.
Effective Performance	Effective Performance reflects the effectiveness of the stakeholder's or institution’s actions and the achievement of its goals. Improved performance validates the cooperative efforts and strengthens stakeholders' belief in the other party's integrity and values.

Table 6: Comprehensive Model of Institutional Trust



Comprehensive Institutional Trust Model

Summary of Diagram Loops

This stock-and-flow diagram, titled the “Comprehensive Institutional Trust Model” in Table 6, provides a detailed view of the mechanisms that shape trust within an ecosystem. It highlights the dynamic interplay between trust-building and trust-depleting actions, illustrating how these forces influence the overall level of **Institutional Trust**.

Key elements such as **honesty**, **transparency**, and **reliability** are essential drivers for building trust. These elements foster a resilient environment for cooperation and engagement among stakeholders, including government, universities, and entrepreneurs. Further, each stakeholder’s actions directly impact trust-building in interrelated ways. For example, the government plays a vital role by **setting policies** that address the needs of the area’s ecosystem and establishing rules for **intellectual property protection**, which provide a framework for secure and fair interactions for other stakeholders. Universities contribute by aligning their **research and educational policies** with targeted opportunities, while entrepreneurs strengthen trust by **adhering to agreements** and ensuring **transparency**. Together, these coordinated actions create a cycle of trust reinforcement, building a stable foundation for collaboration, innovation, and growth within the ecosystem.

The reinforcing feedback loops underscore how **willingness to engage**, **effective communication**, and **aligned agreement of actions** ultimately foster **shared understanding**, which in turn strengthens **relational contracts** and **cooperation** and reinforces trust-building over time.

Additionally, the model demonstrates the importance of **Relational Contracts** and **Relational Contract Effectiveness**, while emphasizing the critical role of **Delay**. Building trust does not instantly enhance the relational contracts effectiveness; rather, it requires institutions and partnerships to exercise patience and consistency. While initial efforts may not yield immediate benefits, reliable actions ultimately establish a solid foundation of relational contract effectiveness, supporting long-term cooperation, resilience, and adaptability across the ecosystem.

Conversely, the model also captures trust-depleting factors (such as **fraud, contract breaches,** and **project failures**) that weaken Institutional Trust and diminish cooperation within the ecosystem. The model includes balancing feedback loops, which demonstrate how trust-depleting factors, such as **ineffective communication** and **disengagement**, can counteract trust-building efforts.

Comprehensive Institutional Trust Model

Summary of Diagram Loops

Breakdown of the Reinforcing and Balancing Feedback Loops:

- **Reinforcing Loop R1: "Trusting"**
    - This loop describes a positive feedback process where increased **Trust building** leads to increased **Institutional Trust** stock level. As institutional trust grows, it reinforces and further incentivizes trust-building actions. Behaviors like reliability, honesty, transparency, and adherence to agreements directly contribute to additional trust-building, forming a self-amplifying cycle.

- **Reinforcing Loop R2: "Cooperation"**
    - This loop builds on the *Trust Causal Loop Diagram* from Figure 3.0 illustrating the self-reinforcing effect of **Effective Communication**, **Aligned Agreement of Actions**, and **Stakeholder Expectations to Perform** on trust and cooperation.
    - Effective communication and alignment of actions boost cooperation among stakeholders, enhancing **Effective Performance** and fulfilling stakeholder expectations leading to **Achieving Returns**. This successful performance builds further trust and cooperation, creating a reinforcing feedback cycle.

- **Reinforcing Loop R3: "Relational Contracts"**
    - This loop integrates variables from R2 above, where initial trust-building increases the **willingness to engage** and promotes **effective communication**. Over time, **Stakeholder Expectations to Perform** drive the alignment of **Task Knowledge** and **Relational Knowledge**, which together foster **Shared Understanding**.
    - This shared understanding is essential for developing **Relational Contracts** (informal agreements), supported by factors such as **Clarity** and **Credibility**. This further promotes **cooperation** and enables these informal agreements to function effectively. In turn, this ultimately feeds back into the **trust-building** process, further strengthening it and creating a reinforcing loop that continuously enhances trust within the system.

- **Reinforcing Loop R4: "Relational Effectiveness"**
    - This loop captures the reinforcing relationship between **Trust building** and **Relational Contract Effectiveness**, with a **Delay** in impact.
        - In system dynamics, a *delay* refers to the gap between an action and its visible effect within a system. “Delays are pervasive. It takes time to

Summary of Diagram Loops

measure and report information. It takes time to make decisions. And it takes time for decisions to affect the state of a system."[41]

- As trust builds, it enhances relational contract effectiveness. This means that stakeholders are more likely to fulfill their obligations, communicate openly, engage in flexible problem-solving, and adapt to each other's needs and feedback. These behaviors enhance the overall effectiveness of **Relational Contracts** and contribute to a more collaborative and resilient environment.
- Trust-building efforts gradually lead to greater relational contract effectiveness, though this impact could unfold over time due to inherent delays. As relational contract effectiveness improves, it strengthens relational contracts and enhances **cooperation,** which ultimately reinforces further trust-building actions. This delayed reinforcing loop illustrates the cumulative benefits of trust on relational contract effectiveness, underscoring the importance of consistent commitment to trust-building efforts to achieve high-performance outcomes over time.

- **Balancing Loop B1: "Communication"**
  - This loop functions as a balancing feedback mechanism, highlighting the inverse relationship between **Trust Depletion** and **Effective Communication**. As trust erodes, communication becomes progressively less effective, resulting in a misalignment of agreed-upon actions. This misalignment weakens **Stakeholder Expectations to Perform**, resulting in underperformance and unmet outcomes. The decline in performance then further hinders **trust-building** efforts, ultimately reducing the overall level of **Institutional Trust** and perpetuating a cycle of diminished trust within the system.

- **Balancing Loop B2: "Engagement"**
  - This balancing loop adjusts the **Willingness to Engage** in response to trust-depleting factors. As **Institutional Trust** levels rise, willingness to engage also increases, which helps counteract **trust depletion** and brings stability to the system. Conversely, reduced engagement accelerates trust depletion, highlighting the loop's role in maintaining balance within the ecosystem.

[41] Sterman, "Business Dynamics," chap 11.

Table 7: Importance of Relational Contracts

Relational Contracts	
Concept	**Description**
Importance	Relational contracts are informal agreements sustained by the "shadow of the future," meaning they rely on the expectation of future interactions rather than legal enforcement. These contracts are vital for managing activities and behaviors that cannot be fully specified in formal agreements. They play a crucial role in organizational settings where flexibility and adaptability are required to respond to unforeseen circumstances.
Credibility and Clarity	The effectiveness of relational contracts depends on solving two primary problems: 1. **Credibility:** Ensuring that parties "believe one's promises" 2. **Clarity:** Ensuring that parties "understand one's promises"
Role in Collaboration Success	Shared understanding refers to the common knowledge and expectations held by all parties involved in a relational contract. It is essential for ensuring smooth and effective collaboration. Without shared understanding, even well-intentioned actions can be misinterpreted, leading to conflicts and breakdowns in cooperation.
Challenges in Developing Relational Contracts	Challenges in developing Shared Understanding to build Relational Contracts can be challenging, especially in complex and dynamic environments. It involves developing: • **Task Knowledge:** Understanding what actions need to be taken by each party to achieve goals. • **Relational Knowledge:** Knowing how their actions could relate to each other and what the consequences and payoffs of the different actions might be.[42]

[42] Robert Gibbons and Rebecca Henderson, "Relational Contracts and Organizational Capabilities," Organization Science 23, no. 5 (2012): 1350–1364.

Additional References

1. Massachusetts Institute of Technology. *Innovation Ecosystems WebApp*. Supported by MIT REAP. https://innovationecosystems.mit.edu/explore-innovation.
2. Massachusetts Institute of Technology (MIT) Regional Entrepreneurship Acceleration Program (MIT REAP). *MIT REAP*. https://reap.mit.edu/
3. Stern, Scott, Fiona Murray, et al. "Accelerating Innovation Ecosystems: The Promise and Challenges of Regional Innovation Engines." *Entrepreneurship and Innovation Policy and the Economy* 3 (2024). https://doi.org/10.3386/w31541.
4. Stern, Scott, Fiona Murray, and Jorge Guzman. *REAP Index: Data Setup & Use Guide*. Cambridge, MA: MIT REAP.
5. Stern, Scott, Fiona Murray, and Jorge Guzman. *REAP Index: Data Overview*. Cambridge, MA: MIT REAP, 2016.
6. Guzman, Jorge, and Scott Stern. *NBER Working Paper—Nowcasting and Placecasting Entrepreneurial Quality and Performance*. Cambridge, MA: National Bureau of Economic Research, 2015. https://www.nber.org/papers/w20954
7. Murray, Fiona, and Scott Stern. *Science article on innovation ecosystems—Linking and Leveraging*. *Science*, 2015. https://www.science.org/doi/10.1126/science.aac5843
8. Murray, Fiona, and Phil Budden. *MIT Stakeholder Framework for Building & Accelerating Innovation Ecosystems*. Cambridge, MA: MIT REAP, 2019.
9. Budden, Phil, Fiona Murray and Anna Turskaya. *A Systematic MIT Approach for Assessing 'Innovation-driven Entrepreneurship' in Ecosystems*. Cambridge, MA: MIT REAP, 2019.
10. Budden, Phil and Fiona Murray. *MIT Lab for Innovation Science and Policy*. Cambridge, MA: MIT, 2019.
11. Murray, Fiona, and Bill Aulet. *Kauffman Foundation report on innovation ecosystems—A Tale of Two Entrepreneurs: Understanding Differences in the Types of Entrepreneurship in the Economy*. Cambridge, MA: Ewing Marion Kauffman Foundation, 2013.
12. Startup Genome. *Global Startup Ecosystem Report*. San Francisco: Startup Genome, 2023. https://startupgenome.com/
13. StartupBlink. *Startup Ecosystem Website*. Singapore: StartupBlink, 2017. https://www.startupblink.com/.
14. StartBlink. *Startup Ecosystem Rankings 2020*. https://drive.google.com/file/d/1ydvc0_jA3g8fC07vzfN8GWqEkP6yQ_Ak/view
15. StartupBlink. *StartupBlink Blog*. https://www.startupblink.com/blog/.
16. Findexable. *Global Fintech Index 2020*. London: Findexable, 2020. https://findexable.com/.
17. MIT. *Startup Cartography Project*. Cambridge, MA: Massachusetts Institute of Technology, 2019. https://startupcartography.org/.
18. Nebraska Department of Economic Development. *2022 Business Innovation Act Impact Analysis*. Lincoln, NE: Nebraska Department of Economic Development, February 2023. https://opportunity.nebraska.gov/wp-content/uploads/2023/02/2022-BIA-Impact-Analysis-1.pdf
19. U.S. Department of Education. *Digest of Education Statistics: Postsecondary Majors Dataset*. Washington, DC: U.S. Department of Education, 2022. https://nces.ed.gov/programs/digest/.
20. Chetty, Raj, John N. Friedman, Nathaniel Hendren, Maggie R. Jones, and Sonya R. Porter. *The Opportunity Atlas: Mapping the Childhood Roots of Social Mobility*. Harvard University and U.S. Census Bureau, 2018. https://www.opportunityatlas.org/.
21. U.S. Patent and Trademark Office. *PatentsView Data Visualization*. Washington, DC: USPTO, 2020. https://www.patentsview.org/visualizations.

22. Aksarben Foundation-Nebraska Inflow Study. Lincoln, NE: *Nebraska Tech Collaborative*, 2019. https://aksarben.org/ntc/
23. Ortiz-Ospina, Esteban, Max Roser, and Pablo Arriagada. “Trust.” *Our World in Data*. First published July 2016; last updated April 2024. Available at https://ourworldindata.org/trust.
24. Pew Research Center. *Trust and Distrust in America*. Washington, DC: Pew Research Center, July 22, 2019. https://www.pewresearch.org/politics/2019/07/22/trust-and-distrust-in-america/.
25. U.S. Census Bureau, *Annual Business Applications by State and County* [interactive visualization], Business Formation Statistics (BFS), U.S. Census Bureau, 2023. https://www.census.gov/econ/bfs/visualizations/countyvisualization.html.
26. Organisation for Economic Co-operation and Development (OECD). “Trust in Government.” *OECD Governance*. https://www.oecd.org/governance/trust-in-government/
27. Organisation for Economic Co-operation and Development (OECD). *OECD Guidelines on Measuring Trust*. Paris: OECD Publishing, 2017. https://doi.org/10.1787/9789264278219-en
28. Association of Collegiate Schools of Planning (ACSP). “Best Paper Award Winners.” *ACSP News & Awards*. https://www.acsp.org/page/BestPaperAwardWinners.
29. Buratti, Martina, Uwe Cantner, James A. Cunningham, Erik E. Lehmann, and Matthias Menter. “The Dynamics of Entrepreneurial Ecosystems: An Empirical Investigation.” *R&D Management* 53, no. 4 (2023): 656–674. https://doi.org/10.1111/radm.12565
30. Cantner, Uwe, James A. Cunningham, Erik E. Lehmann, and Matthias Menter. “Entrepreneurial Ecosystems: A Dynamic Lifecycle Model.” *Small Business Economics* 57, no. 1 (2021): 407–423. https://doi.org/10.1007/s11187-020-00316-0
31. Cloutier, Laurence, and Karim Messeghem. “Whirlwind Model of Entrepreneurial Ecosystem Path Dependence.” *Small Business Economics* 59, no. 2 (2022): 611–625. https://doi.org/10.1007/s11187-021-00553-x
32. Ranaei Kordshouli, H. A., and B. Maleki. “Entrepreneurship Motivation and Institutions: System Dynamics and Scenario Planning.” *Journal of Global Entrepreneurship Research* 13, no. 6 (2023). https://doi.org/10.1007/s40497-023-00348-2
33. OECD. *Entrepreneurial Ecosystems and Growth-Oriented Entrepreneurship*. Paris: OECD, 2014. https://www.oecd.org/cfe/leed/Entrepreneurial-ecosystems.pdf.
34. Jinfeng Lu and Dimo Dimov, “A System Dynamics Modelling of Entrepreneurship and Growth Within Firms,” *Journal of Business Venturing* 38, no. 3 (2023): Article 106285, https://doi.org/10.1016/j.jbusvent.2022.106285
35. National Science Foundation. *NSF Regional Innovation Engines (NSF Engines) Broad Agency Announcement (BAA)*. Arlington, VA: NSF, May 2022.
36. Ewing Marion Kauffman Foundation. *Challenges for Entrepreneurs in the Heartland* (Trends in Entrepreneurship, No. 7). Kansas City, MO: Ewing Marion Kauffman Foundation, June 2020. https://www.kauffman.org/wp-content/uploads/2020/06/Kauffman_Trends-in-Entrepreneurship-7_Challenges-For-Entrepreneurs-in-the-Heartland_2020.pdf
37. Caroline Taich, Merissa Piazza, Kara Carter, and Alexa Wilcox, *Measuring Entrepreneurial Ecosystems*, report, Center for Economic Development, Maxine Goodman Levin School of Urban Affairs, Cleveland State University, December 2016, https://engagedscholarship.csuohio.edu/urban_facpub/1452/
38. Daniela Bolzani, Einar Rasmussen, and Riccardo Fini, “Spin-offs’ Linkages to Their Parent Universities over Time: The Performance Implications of Equity, Geographical Proximity, and Technological Ties,” *Strategic Entrepreneurship Journal* 15, no. 4 (2020): 590–618, https://doi.org/10.1002/sej.1359
39. Innosphere Ventures (Colorado–Wyoming Climate Resilience Engine), “Home — CO-WY Engine,” https://www.co-wyengine.org/.

40. National Science Foundation. *Regional Innovation Engines Initiative*. Arlington, VA: NSF, 2022. https://new.nsf.gov/funding/initiatives/regional-innovation-engines.
41. Goșchin, Zizi. “R&D as an Engine of Regional Economic Growth in Romania.” *Romanian Journal of Regional Science* 11, no. 1 (2014): 24–43. https://rjrs.ase.ro/wp-content/uploads/2017/03/V81/V812.Goschin.pdf.
42. Pourya Abbasi and R. Radfar, “Modeling Open R&D Ecosystem via System Dynamics Approach: A Case Study on Nanotechnology,” *Journal of System Management* 1, no. 1 (2022): 19, https://www.researchgate.net/publication/361490698_Modeling_Open_RD_Ecosystem_Via_System_Dynamics_Approach_A_Case_Study_Nanotechnology
43. Roberts, Edward B., and Charles E. Eesley. *The MIT Impact Study: The Role of MIT and Its Alumni in Entrepreneurship and Innovation*. Kansas City: Ewing Marion Kauffman Foundation, 2009. https://www.kauffman.org/wp-content/uploads/2009/02/mit_impact_full_report.pdf.
44. “Ecosystem Services and the Tansley Principle.” *ScienceDirect Topics*. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/tansley.
45. Gutscher, Andreas, Jessica Heesen, and Oliver Siemoneit. “Possibilities and Limitations of Modeling Trust and Reputation.” In *Proceedings of the Fifth International Workshop on Philosophy and Informatics (WSPI-2008)*, edited by Manuel Möller, Thomas Roth-Berghofer, and Wolfgang Neuser, 14–18. CEUR Workshop Proceedings, vol. 332. Kaiserslautern, Germany: CEUR-WS.org, 2008. https://ceur-ws.org/Vol-332/paper6.pdf
46. Kania, John, and Mark Kramer. “Collective Impact.” *Stanford Social Innovation Review* 9, no. 1 (Winter 2011).
47. Budden, Phil. *Innovation Ecosystems for Regional Entrepreneurship*. iEco4REAL 15.364. Course material, Massachusetts Institute of Technology, 2024.
48. Gibbons, Robert, and Michael Whinston. *Applied Economics for Managers*. 15.722. Course material, Massachusetts Institute of Technology, 2022.
49. Sterman, John. *Introduction to System Dynamics*. 15.736. Course material, Massachusetts Institute of Technology, 2023.
50. Sterman, John. *Advanced System Dynamics*. 15.737. Course material, Massachusetts Institute of Technology, 2024.
51. Rigobon, Roberto. *Advanced Applied Macroeconomics and International Institutions*. 15.723. Course material, Massachusetts Institute of Technology, 2024.
52. Akinc, Bridget, and Nelson Repenning. *Leading with Impact*. 15.703. Course material, Massachusetts Institute of Technology, 2024.
53. Gary, Michael Shayne, Miles M. Yang, Philip W. Yetton, and John D. Sterman. “Stretch Goals and the Distribution of Organizational Performance.” *Organization Science* 28, no. 3 (May–June 2017): 395–410. https://doi.org/10.1287/orsc.2017.1131
54. Gibbons, Robert, Jordan Siegel, and Roberto A. Weber. “Strategy Meets Culture (for Breakfast): Understanding the Relationship and Highlighting Its Potential.” *Strategy Science* 6, no. 2 (June 2021): 111–118. https://doi.org/10.1287/stsc.2021.0138.