Endemic Innovation: Unlocking Sustainable Innovation-Driven Development from What Makes Us Unique

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Article

Keywords:

DOI: https://doi.org/

Additional Declarations: No competing interests reported.

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Abstract

Innovation models often emphasize scalability and standardization, overlooking the value embedded in territorial singularities. This paper introduces the concept of Endemic Innovation (EI), a framework for generating globally relevant solutions derived from non-replicable geographical, ecological, cultural, and institutional conditions. We define the key pillars of EI, present a five-stage operational model, and illustrate the framework through case studies from Argentina, Brazil, Chile, Finland, New Zealand, Portugal, and US. By leveraging endemic resources and integrating them with exogenous technologies, EI offers a novel pathway for sustainable development and reframes the Global South as a generator of world-class innovation. Our findings highlight the strategic potential of singular territories and propose a new geography of innovation anchored in uniqueness rather than imitation.

1. Introduction

In today's globalized world, markets and technologies are increasingly standardized. However, paradoxically, the importance of local uniqueness – each region's particular geographic, ecological, and cultural context – is greater than ever. Regions that harness distinctive assets can gain competitive advantages that others cannot easily replicate (Martínez Pereira, 2025a). However, the standard "catch-up" model of innovation, in which developing countries imitate or import frontier technologies, has yielded only partial success. In many emerging economies, firms underinvest in innovation and advanced technology adoption – not for lack of ambition, but in response to pragmatic constraints such as scarce human capital, weak infrastructure, and uncertain market demand (Khanna & Palepu, 2010; Cirera & Maloney, 2017; McMeekin et al., 2018). This counterintuitive outcome is often described as an "innovation paradox." In effect, even when the potential returns to innovation are high, structural challenges and risk can stifle investment (Cirera & Maloney, 2017). Consequently, numerous countries remain stuck in a "middle-income trap," unable to transition from resource-driven or efficiency-driven growth to innovation-led development (Zhou & Hu, 2021).

These patterns call for rethinking how Innovation is pursued in the Global South. We propose **Endemic Innovation** as an alternative paradigm – a novel, context-driven model of innovation-led development tailored to each region's unique strengths. Endemic Innovation is defined as developing unique solutions to a particular region, rooted in that region's hard-to-replicate geographic, ecological, cultural, or institutional conditions (Martínez Pereira, 2025a). In contrast to conventional approaches that attempt to transplant global technologies into local contexts, this model begins with indigenous strengths and assets. Endemic Innovation converts local uniqueness into a driver of competitive advantage and global value by leveraging what is singular about a place – rich biodiversity, an extreme climate, or a centuries-old craft tradition. For instance, a country with a unique medicinal plant ecosystem might develop novel bio-based pharmaceuticals instead of importing standard solutions, while a region facing harsh desert

challenges could pioneer climate-resilient agricultural techniques suited to its terrain. In each case, a local condition becomes a springboard for Innovation with far-reaching relevance. In essence, this approach reframes the Global South not as a late adopter of others' ideas, but as a source of original, world-class solutions.

The significance of this perspective is underscored by its connection to long-standing insights in development theory. Bravo-Ortega and colleagues argued that converting natural resource endowments into sustained growth requires building strong local innovation capabilities and knowledge networks (Bravo-Ortega & De Gregorio, 2007). Likewise, Lederman and Maloney note that firms in developing economies often face heightened uncertainty and market failures around innovation, which can stifle technological adoption and diversification (Lederman & Maloney, 2012). These insights help explain why a new approach is needed: one that can cultivate homegrown innovation despite uncertain environments and capability gaps. By focusing explicitly on unique regional endowments, the Endemic Innovation framework addresses this need, providing a structured pathway for countries to leapfrog technologically and achieve structural transformation on their terms.

Endemic Innovation is proposed as an alternative strategic model tailored for emerging and developing economies and is defined here as *"the process of developing sustainable solutions that are unique and exclusive to a particular region of the world, based on and explained by geographical, climatic, cultural, historical, institutional, or technological singularities. These solutions present structural comparative advantages by emerging from hard-to-replicate contexts, creating differential value with both local and global impact."* (Martínez Pereira, 2025a). In contrast to standard innovation approaches, it is *not* about simply adapting a global technology locally, nor just a delayed "catch-up" mechanism. Rather, endemic innovation starts from local strengths and singularities – the "endemic" features of a region – and uses them as levers for competitive value creation. By harnessing what makes a region special (be it a rich and rare biodiversity, extreme climate or geography, traditional know-how, or unique social conditions), this model transforms local singularities into drivers of industrial and social transformation (Martínez Pereira, 2025a). For example, one can ask: if the Amazon rainforest's rich biodiversity, or Iceland's volcanoes, or the ancestral craft traditions of Bali are viewed not as mere curiosities but as innovation assets, how can they be converted into high-impact solutions?

To ground this concept, we first outline its theoretical foundations vis-à-vis established innovation theories and identify key preconditions that enable endemic innovation. We then present a five-stage process model of endemic innovation, illustrating each stage with real-world cases from diverse contexts (Latin America, Africa, Asia, Oceania, and beyond). Throughout this process, we discuss how firms and innovation ecosystems manage uncertainties (from market demand to institutional voids). Finally, we offer a discussion on strategic and policy implications – how firms and governments (particularly in the Global South) can leverage endemic innovation for sustainable development, in alignment with the Sustainable Development Goals (SDGs) and inclusive innovation objectives.

2. Theoretical Foundations of Endemic Innovation

The concept of Endemic Innovation builds upon several theoretical frameworks. It aligns with evolutionary economics (Nelson & Winter, 1982) in viewing Innovation as a path-dependent process shaped by local knowledge and routines. It resonates with the National/Regional Innovation Systems perspective (Freeman, 1987; Cooke, 1992), emphasising how geographic context, institutions, and networks influence innovation outcomes. Endemic Innovation can be seen as a special case of a regional innovation system exploiting a unique knowledge niche (Freeman, 1987; Andersson et al., 2023). It also extends the firm's natural resource-based view (NRBV) (Hart, 1995) by suggesting that unique environmental assets are not just constraints to manage, but strategic drivers of Innovation when coupled with capabilities. The NRBV argued that firms could achieve sustainable competitive advantage by addressing environmental challenges (Hart, 1995); here we argue that firms can gain an advantage by embracing geographic, ecological, cultural, and institutional uniqueness as sources of Innovation. Moreover, dynamic capabilities theory (Teece et al., 1997; Teece et al., 2007) is integral: firms must continually integrate, build, and reconfigure local and global knowledge to capitalize on ephemeral opportunities in uncertain markets. Finally, Justin Lin's idea of "New Structural Economics" (Lin, 2012) – that countries should leverage their latent comparative advantages – provides a macro-level rationale for focusing on endemic strengths. However, our framework goes beyond Lin's emphasis on factor endowments by incorporating how technology and innovation policy can elevate those endowments to high-value activities.

Endemic Innovation sits at the intersection of development economics and innovation management: it requires the supportive institutions highlighted by growth theorists (Acemoglu & Robinson, 2012), the interactive learning stressed by innovation systems scholars (Lundvall, 1992; Edquist, 1997), and the strategic vision within firms to marry local and global knowledge (Teece, 2014).

As mentioned previously, Endemic innovation (EI) builds upon and extends several bodies of theory in economics and management, blending them into a new framework suited for innovation-driven development:

2.1. Evolutionary Economics: The evolutionary view (Nelson & Winter, 1982) sees innovation as a process of variation and selection, shaped by path-dependency and local search. In developing countries, firms find creative solutions by necessity, adapting to local challenges through a trial-and-error "self-discovery" process (Hausmann & Rodrik, 2003). Hausmann and Rodrik describe how entrepreneurs must discover which new products or processes can be viable in their economy, since that knowledge is not obvious ex ante (Virkkala & Mariussen, 2018). Endemic innovation provides a framework for such discovery: it posits that the "menu" of valuable innovations is highly contingent on local context. Over time, successful endemic innovations accumulate as an evolutionary trajectory for the region. For example, Portugal's mastery of new cork-based technologies and applications emerged from decades of experimentation with this country's endemic resource, gradually building a comparative advantage in sustainable cork harvesting, advanced granulation techniques, and applications in flooring, insulation, and composite materials. This aligns with evolutionary theory's emphasis on building upon existing capabilities and incremental learning.

2.2. National and Regional Innovation Systems (NIS/RIS): The NIS perspective emphasises that innovation performance depends on a network of institutions and actors (firms, universities, government, etc.) and their interactions within a country (Freeman, 1987; Andersson et al., 2023). Freeman (1987) and Lundvall (1992) noted that countries with well-developed national innovation systems are better at learning and innovating. Likewise, regional innovation systems focus on localised networks and clusters (e.g., Silicon Valley) that foster innovation. Endemic innovation aligns with NIS/RIS by stressing the importance of an enabling ecosystem – including supportive policies, research institutions, and collaboration platforms – but it sharpens the focus to place-specific assets. It argues that when national or regional systems consciously nurture unique local resources and knowledge (for instance, New Zealand investing in bio-research around its indigenous flora, or Finland's network of forestry institutes advancing cellulose-based biomaterials), they create innovations that outsiders cannot easily replicate. (Martínez Pereira, 2025b). In other words, a strong innovation system that connects unique resources, public and private capabilities (policy support, universities, companies) with community and firm-level knowledge is a critical enabler for endemic innovation.

2.3. Dynamic Capabilities: Teece's dynamic capabilities framework explains how firms can achieve sustained innovation by continuously integrating and reconfiguring resources in response to change. Dynamic capabilities are "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece et al., 1997). For endemic innovation, dynamic capabilities are crucial at the firm and ecosystem levels. Firms need the agility to combine *local* knowledge or resources with *global* technologies. For instance, the startup Woamy leverages Finland's endemic knowledge of cellulose (a polymer derived from wood fibers) to create a new cellulose-based material, a biodegradable and highly resistant foam that could revolutionize the global polystyrene market, a $30 billion industry dominated by environmentally toxic materials (Martínez Pereira, 2025b). This included mapping opportunities in endemic resources, seizing them by investing in technology and product development, and reconfiguring operations to work closely with local communities. The concept of dynamic capabilities also underscores the role of managerial strategies and vision – leaders must recognise the value of their region's unique assets and pivot the organisation to capitalise on them. In volatile developing markets, those who can quickly adapt and recombine local and foreign knowledge (e.g., startups that blend indigenous techniques with AI) will drive endemic innovation.

2.4. Absorptive Capacity: Cohen and Levinthal (1990) introduced absorptive capacity as a firm's *ability to recognise the value of new external information, assimilate it, and apply it for commercial purposes (*Fernandes & Ferreira, 2023). This is especially vital for combining an *endemic opportunity (a unique resource or knowledge)* with *exogenous technology*. Endemic innovations do not happen in isolation from global science; instead, they often require local insight or resource synergy with cutting-edge external technologies. A strong absorptive capacity allows local innovators to scan the global technological frontier and bring relevant advancements. High absorptive capacity might come from investing in R&D, building partnerships with universities, or hiring talent with international experience. In practice, many of our case examples illustrate this: a Chilean biotech startup harnessing an endemic

microorganism still needed gene-sequencing technology developed abroad; an Icelandic geothermal company leveraged AI algorithms from global tech firms to optimise a process rooted in local geology (Martínez Pereira, 2025b). Without absorptive capacity, unique local resources might remain underexploited curiosities. Thus, integrating global knowledge with local resources is a pillar of the endemic innovation model, resonating with the concept of dynamic capabilities and the resource-based view.

2.5. Resource-Based View (RBV) and Natural Resource-Based View: The RBV in strategy posits that competitive advantage of firms stem from owning valuable, rare, inimitable and non-substitutable resources (Barney, 1991). Endemic innovation seeks to identify resources or capabilities that are uniquely available (or developed) in a region – and by virtue of their rarity or context-specific nature (the endemic condition), can form the basis of durable competitive advantage. When these resources are natural (e.g. a specific climate, mineral, biodiversity) or culturally embedded, we enter the realm of Hart's Natural Resource-Based View (NRBV) (Hart, 1995). Hart argued that in an era of environmental constraints, firms building strategies around sustainable use of natural resources can achieve new forms of advantage. Endemic innovation focuses on unique resources, not only from the perspective of sound environmental management, but also from the perspective of the intelligent and sustainable use of these unique singularities as drivers of innovation: for example, New Zealand's Manuka honey industry draws on a native plant found only in that ecosystem – a natural asset coupled with indigenous knowledge. By investing in scientific research on that resource, firms like Comvita created products with healing properties that competitors elsewhere simply cannot imitate without the same natural resource and knowledge (Martínez Pereira, 2025b).

2.6. Structural and Dynamic Comparative Advantage: Classical trade theory argues that nations should specialise according to static factor endowments. Justin Lin's idea of structural comparative advantage (Lin, 2012) updates that view: governments can steer investment toward industries that are *latent* extensions of existing strengths, turning, for example, Portugal's cork forests into a world-leading biomaterials platform through Amorim's sustained R&D and design upgrades. Endemic Innovation embeds Lin's insight in a broader dynamic comparative-advantage logic. Structural advantage supplies the *starting lattice*—the material assets, skills, and cultural know-how distinguishing a territory. Dynamic comparative advantage, in turn, captures the *evolutionary climb* that follows, a process long emphasised in the growth-and-trade literature as nations move up the value chain through learning, scale, and Innovation (Pavitt, 1984; Balassa, 1989; Krugman, 1987; Grossman & Helpman, 1991; Porter, 1990; Venables et al., 2007).

In practical terms, structural advantages answer "Why here?"—Iceland's geothermal reservoirs, Chile's extremophile microbes, Uganda's high-strength banana fibre. Dynamic advantages answer "What next?"—how firms wield absorptive capacity and dynamic capabilities (Teece, Pisano, & Shuen, 1997) to recombine those endemic resources with frontier technologies, shifting comparative advantage upward over time. When policymakers recognise the structural assets *and* invest in the institutions, skills, and risk-sharing mechanisms that fuel dynamic upgrading—lead-customer procurement, pilot funds, export standards—they convert what might have remained raw commodities into resilient, high-value industries. Endemic Innovation thus operationalises structural comparative advantage while furnishing the engines

that keep it moving, ensuring place-based resources are not a ceiling but a launchpad for sustained, cumulative growth.

In summary, the endemic innovation model is grounded in solid theoretical principles: it draws on innovation systems theory to emphasize the relevance of networks and institutions; it embraces evolutionary and capability-based views to stress learning and adaptation; it leverages RBV/NRBV to highlight the strategic role of unique resources; and it heeds structural economics in aligning innovation with a country's intrinsic strengths. By integrating these, endemic innovation addresses some pitfalls of standard catch-up models. Instead of attempting to replicate foreign innovations in an environment where complementary factors are missing, it starts from *what the environment offers*. It aligns with calls for contextualised innovation, recognizing that "one-size-fits-all" technologies often fail in developing contexts due to mismatched conditions. Endemic innovation posits that the Global South can forge different innovation pathways from the North's, yet no less technologically sophisticated or valuable.

3. Preconditions for Endemic Innovation

Although any region has some unique attributes, **successful endemic innovation does not happen automatically**. Certain *preconditions* and enablers must be in place to convert a latent local advantage into an innovative outcome (*see Figure 1*):

[Insert Figure 1 here]

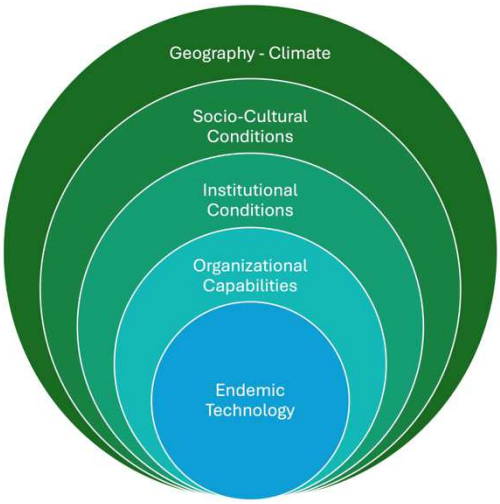

***Figure 1**: The five layers of preconditions for Endemic Innovation*

3.1. Geography and Climate: Biophysical factors, such as geography, climate, or biodiversity, play a crucial role in endemic innovations by providing the natural conditions and resources that shape and define the solutions most likely to emerge from these areas.

3.2. Socio-Cultural Conditions and Vision: One often overlooked precondition is the mindset about innovation. Local pride in heritage can be a powerful motivator for endemic innovation. A *cultural narrative* valuing local uniqueness can energise innovation efforts across sectors. Leaders—whether in government, academia, or business—play a role in articulating such a vision. Endemic innovation often requires challenging the inferiority complex that sometimes

exists in developing countries ("imported solutions are better"). A visionary stance that "our challenges and our heritage can inspire world-class innovation" is a powerful intangible asset.

3.3. Institutional Conditions: A stable, supportive institutional environment is fundamental. Research by Acemoglu et al. (2001) has shown that **inclusive institutions** – which secure property rights, enforce contracts, and encourage broad participation – are key drivers of innovation and prosperity (Pampillón, 2024). In contrast, extractive institutions that concentrate power and deter entrepreneurship will stifle even the best ideas. Developing countries need governance that rewards innovation and experimentation. This can include R&D tax credits, strong legal protection for intellectual property (to give local innovators confidence), and removal of bureaucratic obstacles. Equally important, governments should craft innovation policies (Edler & Georghiou, 2007) that target endemic strengths and opportunities.

While not unique to endemic innovation, basic infrastructure (transport, internet, energy, workspaces) and access to finance are general preconditions. However, the type of finance needed might differ: *early-stage patient capital willing to invest in unproven, novel ideas with a local flavour.* Traditional VCs might shy away from a startup making building materials from mushroom mycelium in Chile because it sounds too unconventional. Here, development banks, impact investors, or public innovation funds become crucial in providing seed funding. Additionally, **market infrastructure** may need development – for example, creating certification standards to help an endemic product gain global trust, or setting up incubators and living labs where new tech can be tested in local conditions (e.g., proving a new irrigation system with local farmers). These supports increase the likelihood that an endemic innovation can move from concept to market. T*he ground must be fertile* for endemic innovation to take root.

3.4. Organisational Capabilities: Endemic innovation often requires partnerships between public vision and private execution. The state can help by investing in basic science or infrastructure that individual firms cannot afford, while firms bring agility and market knowledge. An **innovation ecosystem** that connects universities, government labs, startups, investors, and community stakeholders dramatically increases the chances that a regional idea will mature into a viable innovation.

Endemic innovation thrives when local communities are not just beneficiaries but co-creators. Many unique opportunities lie in traditional knowledge or community practices (e.g., indigenous medicinal knowledge, artisan techniques, agricultural practices adapted to local ecologies). Engaging with communities unlocks this tacit knowledge and ensures culturally appropriate innovation. Community engagement also builds local buy-in, making implementation easier. From a capability standpoint, educating and training local talent is vital. Regions need skilled professionals (engineers, scientists, designers) who understand modern technology and the local context (Figueiredo P.N., 2010). Specialised education and training programs can foster this mix. Governments and universities should incorporate curricula emphasizing valorizing local resources and knowledge for innovation (Martínez Pereira, 2025b).

3.5. Endemic Technology: At the core of the Endemic Innovation model lies an advanced knowledge, patent, or technology based on the unique resources and conditions present in a specific region, which we will call Endemic Technology (ET). These endemic technologies (ETs) are characterised by being highly distinctive and difficult to replicate outside their original context, providing a significant competitive advantage to the companies that develop them. A recurring pattern in the studied cases is the strategic combination of a base endemic knowledge or resource with one or more cutting-edge exogenous technologies, such as biotechnology, nanotechnology, artificial intelligence, 3D printing, or robotics, which act as catalysts to refine, transform, enhance, or scale the base endemic technology (Martínez Pereira, 2025b).

This synergy of technologies is intrinsically related to a fundamental concept in innovation, previously cited in this article: Absorptive Capacity, defined by Cohen and Levinthal (1990) as "the ability to recognise the value of new knowledge (or technologies), acquire, assimilate, and apply it for commercial purposes". Thus, companies leading world-class endemic innovations *develop advanced native R&D knowledge, which they combine with exogenous technologies to accelerate and exploit these endemic resources in a unique and highly difficult-to-replicate manner.*

This generates a triple competitive advantage, explained by the solution's singularity, the low probability of replicating it in other geographies with different conditions and factors, and a particular combination with a mix of cutting-edge technologies that amplify the impact of the base endemic technology.

4. Case Selection

The research approach is a qualitative, multiple case study design (Yin, 2014) combined with elements of comparative analysis. We chose this approach given the exploratory nature of the Endemic Innovation concept. We aim to *develop* and illustrate the concept, iteratively refining theory with evidence. Of the more than 60 cases studied for this research, those selected serve as instrumental examples for understanding the broader phenomenon. (Stake, 1995).

4.1. Case Selection Criteria

We selected five country cases. Three cases of consolidated innovations: Natura (Brazil), Netafim (Israel), and Comvita (New Zealand), and two cases of emerging innovations: Spora (Chile), and Bloom (US). The criteria were:

1. Presence of a well-documented innovation or set of innovations rooted in a unique local resource/context.
2. Evidence shows that innovation achieves an impact beyond the local level (e.g., being exported, adopted elsewhere, or contributing significantly to the country’s global economic integration).
3. Diversity in geography and income level ensures the concept is illustrated in varied settings.
4. Relevance in policy discussions (many of these countries are often cited in debates on how to avoid the resource curse or diversify economies).

4.2. Analysis Procedure

Each case was written up as a mini-case study, describing: (a) the unique asset or context, (b) the innovation that was developed and its timeline, (c) how it integrated external knowledge or underwent development stages, (d) its outcomes locally and globally, and (e) any challenges or limits encountered. We treated the cases as confirmation of the concept and as sources of refinement. If a case appeared to deviate, we examined why. For instance, if an innovation did not scale globally, was it truly an "endemic innovation" or missing a stage? These considerations helped ensure our conceptual framework stayed grounded.

4.3.1. Consolidated endemic innovations

In the arid Negev Desert, a group of Israeli farmers and engineers pioneered a radical way to coax crops from sand: drip irrigation. That homegrown invention gave birth to Netafim, a company now operating in over 110 countries. Netafim has continuously incorporated IoT sensors and data analytics to refine its desert-born irrigation systems, keeping them state-of-the-art. These synergies between local and global knowledge do not happen accidentally – they result from deliberate investment in skills and partnerships. Today, Netafim is the global leader in precision irrigation, saving 40 billion m^3 of water annually (Netafim, 2020, 2021). Israel's unique combination of water scarcity, agricultural ambition, and technological ingenuity made this innovation possible—a quintessential example of Endemic Innovation.

The Manuka tree, revered by the Māori as taonga (treasure), has been used for centuries for its medicinal properties—treating wounds, infections, and respiratory ailments. In the 1970s, New Zealand scientists discovered that Manuka honey contains uniquely high levels of methylglyoxal (MGO), a compound with unparalleled antibacterial activity. In 1974, Comvita transformed this ancestral knowledge into a global wellness brand, leveraging New Zealand's pristine ecosystems to produce endemic medical-grade Manuka honey. Comvita controls 50% of the $1.2 billion global Manuka market today, blending Māori wisdom with cutting-edge science to redefine natural healthcare.

Brazil's Natura built a global R&D program around the country's unparalleled botanical diversity, yielding cosmetics and fragrances impossible to create outside the Amazon's ecological tapestry. When global consumers began seeking sustainable, plant-based ingredients, Natura built an entire product line around Amazonian oils like açaí and copaíba. Natura turned a regional ecological treasure into a billion-dollar export niche by marrying traditional rainforest bio-knowledge with AI-guided formulation and eco-friendly packaging. Natura provides a template – sourcing ingredients through fair-trade agreements with Amazonian cooperatives and investing in community development, effectively turning previously marginalized villages into key stakeholders in a global value chain. This collaborative model not only strengthens its supply chain but also reinforces its identity as a sustainability leader, earning it the distinction of being the largest B Corp-certified company in the world and the first publicly traded company to receive this certification (Natura & Co., 2025). As in this case, Endemic Innovation thus calls on firms to treat the local context not as a hurdle to overcome, but as the cornerstone of competitive strategy.

Such stories exemplify Endemic Innovation—a paradigm in which a region's unique ecological and cultural endowments become springboards for world-class solutions. This model challenges the standard "import-and-imitate" development playbook and reframes the Global South's role: no longer a late adopter of others' ideas, but a wellspring of original innovations tailored to local challenges and with global relevance. By harnessing the "DNA of place" – those hard-to-replicate features honed by geography, climate, and culture – regions convert local singularities into competitive advantage and sustainable development gains.

4.3.2. Emerging endemic innovations

Chile, a biodiversity hotspot with 7,000+ endemic species, is home to some of the world's most pristine ecosystems, from the Atacama Desert to the rainforests of Patagonia. This unique flora and fauna have inspired a wave of bio-innovation. Founded in 2018 by a team of Chilean scientists and entrepreneurs, Spora leverages Chile's fungal diversity to create mycelium-based biomaterials that disrupt the $1.5 trillion textile industry. Spora's innovation is rooted in Chile's endemic fungi, sourced from remote ecosystems like the Valdivian Rainforest, a UNESCO Biosphere Reserve. These fungi, adapted to extreme conditions (e.g., drought, salinity, extreme temperatures), produce mycelium with unique structural and chemical properties. Spora's patented "end-to-end" process combines traditional mycological knowledge—cultivating endemic fungi on organic substrates like agricultural byproducts—using AI, genome editing, synthetic biology, and nanotechnology. Using Patagonian endemic fungal species allows the Spora team to produce a leather-like material with competitive mechanical properties and water resistance, with similar performance to conventional animal leather and synthetic alternatives. This bioprocess is protected by patents in the US (USPTO), Europe (EPO), and globally (PCT), ensuring a competitive edge in the $2.3 billion biomaterials market.

Locally, Spora is driving Chile's bioeconomy and innovation ecosystem, highlighting the use of endemic resources alongside high technology. Globally, mycelium fabrics are soon to be used by luxury brands such as Burberry or Gucci, reducing their dependence on animal leather and synthetic materials. Spora's European expansion, planned for 2026, will establish production sites near fashion capitals such as Milan, London and Paris, enabling rapid prototyping and reducing lead times by 50% (Martínez Pereira, 2025b). By licensing its technology to European mushroom farms, Spora ensures scalability while maintaining control over quality and sustainability standards. Spora exemplifies how endemic innovation can transform a local resource—Chile's Patagonian fungal diversity—into a global solution for one of the planet's most polluting industries. Its success underscores the power of biomimicry: by learning from nature, we can create a future where fashion is both beautiful and sustainable.

Bloom represents another outstanding example that transforms a local environmental challenge into a technological and economic opportunity. Based in Mississippi, the company focuses on extracting and processing invasive algae from local aquatic ecosystems, whose uncontrolled growth generates severe ecological imbalances. Through a patented method, Bloom converts these algae into a biodegradable bioplastic with applications across a wide range of products from packaging to sustainable footwear. This process combines the utilization of an endemic resource (specific invasive algae from local ecosystems) with advanced polymer engineering technologies, resulting in a unique, high-added-value, and environmentally sustainable technology. Bloom currently has product co-development partnerships with companies like

Adidas, Levi's, Puma, and Porsche Design, which are already incorporating these sustainable algae- based biomaterials into their products.

Moreover, Bloom integrates local communities into the collection process, simultaneously generating economic and environmental benefits. This case not only highlights the intelligent use of unique natural resources but also demonstrates how the absorption and integration of cutting-edge exogenous technologies can transform an environmental problem into a sustainable comparative advantage, becoming a paradigmatic case of Endemic Innovation.

4.4. Limitations

Our methodological approach has limitations. By selecting successful cases, we run the risk of **selection on the dependent variable** – focusing on successes might overlook instances where leveraging local uniqueness failed or led to dead ends. Another limitation is generalizability: we cannot perform statistical analysis with five cases (of the more than 60 that we have already mapped worldwide), each complex in its own right (consolidated and emerging innovations). Our goal, however, is theory building (analytical generalisation) rather than statistical generalisation. The diversity of cases is meant to cover several scenarios to make the arguments plausible broadly.

This analysis reveals that Endemic Innovation is not a fortuitous process but a phenomenon that can be mapped, modeled, and systematized by integrating key elements such as unique natural resources, advanced organizational capabilities, conducive institutional frameworks, and complementary exogenous technologies.

5. Model for the Development and Diffusion of Endemic Innovations

Delving into a practical model that explains and systematizes the development and diffusion process of endemic innovations is crucial. We will explore the stages and metrics underlying these innovations, from mapping and identifying endemic resources and opportunities to their global scaling and dissemination. This five-stage sequential framework (*see figure 2*) will clarify the process and provide a robust model for future studies and practical applications in endemic innovation. Details of the application of each stage can be found in the Springer Nature Article "Operationalizing Endemic Innovation: A 5-Stage Roadmap with Tools & Tactics" by Martínez Pereira (2025c).

The study of international cases of this type of innovation allows us to detect a clear pattern of the process that has been followed, either strategically or tacitly, by many companies that have managed to find a sustainable model based on the unique resources and capabilities of a particular company in a specific region of the world. These defined stages are the following:
[Insert Figure 2 here]

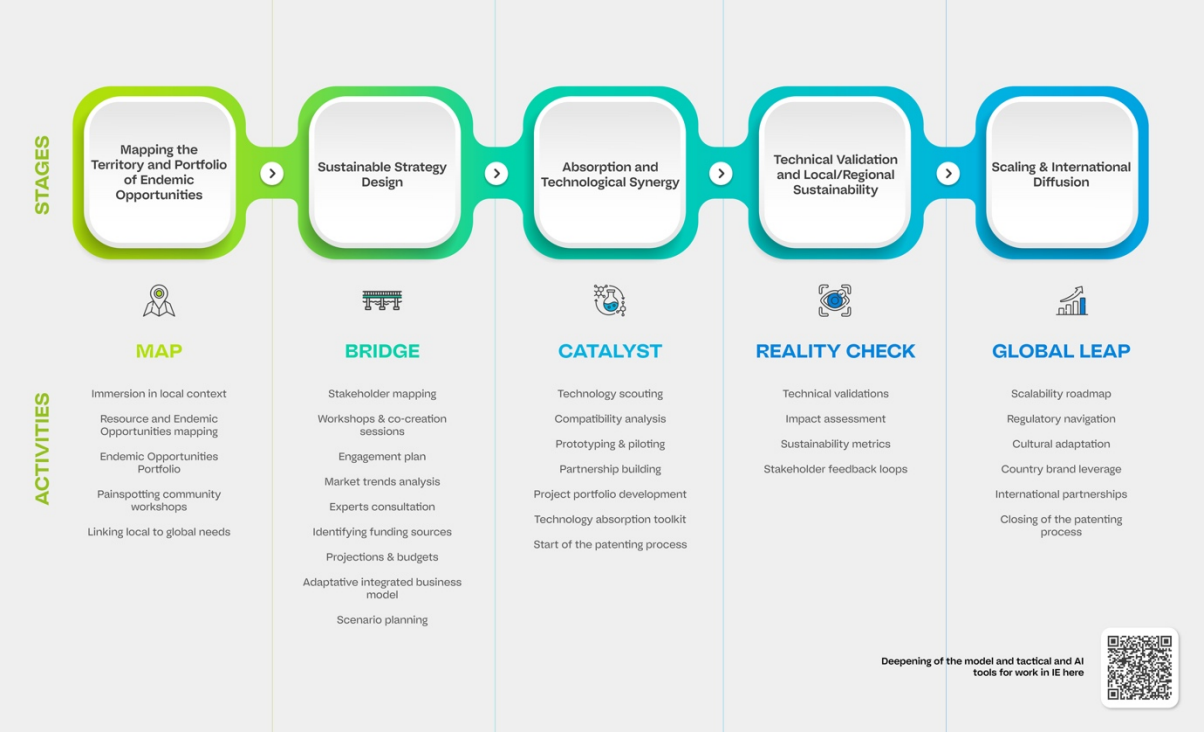

***Figure 2**: The five stages of the EI Model*

5.1. Mapping the Territory and Porfolio of Endemic Opportunities

Before you can innovate, you must see—not just observe, but deeply understand—the invisible assets around you. This stage is about unearthing the raw materials of EI model, the Endemic Opportunities: resources, species, rituals, crafts, and stories that competitors can't copy, whose properties constitute an opportunity to generate technological, medical, food, energy, or biological innovations. This involves mapping the territory to identify endemic opportunities that can be transformed into sustainable global value (Martínez Pereira, 2025c).

5.2. Sustainable Strategy Design

Ideas alone don't create unique solutions or change systems. This phase transforms raw assets into actionable sustainable strategies that balance tradition and modernity. Here we are going to focus on crafting a strategic plan with a long-term vision, including stakeholder collaborations (local community, government, industry, academia), and financing strategies. It's the bridge between endemic opportunities and global markets, proposing an adaptive R&D model combining basic science and practical sustainable applications (Martínez Pereira, 2025c).

5.3. Absorption and Technological Synergy

Endemic resources and strategies are powerful, but their full potential emerges only when paired with the right external knowledge and technologies. This stage integrates exogenous innovations or technologies—think AI, biotechnology, robotics or 3D Printing—to refine and amplify local assets, turning them into scalable, market-ready solutions. It's the catalyst that bridges the gap between raw endemic potential and practical, sustainable innovations, creating a "technology toolkit" and a portfolio of projects that governments and companies can leverage for sustainable growth (Martínez Pereira, 2025c).

5.4. Technical Validation and Local/Regional Sustainability

Innovations must prove their worth in the real world, not just on paper. This is the stage where technological integration is validated, prototypes are tested in local and regional contexts, to ensure they are sustainable, culturally relevant and impactful before being scaled up. It is the reality check that validates solutions, using metrics and an *"Endemic Innovation Index"* (Martínez Pereira, 2025a) to measure socio-economic and environmental outcomes, paving the way for global expansion (Martínez Pereira, 2025c).

5.5. Scaling and International Dissemination

Endemic innovations are too valuable to remain local—they're built to solve global challenges while staying rooted in cultural identity. This stage scales solutions internationally, navigating regulatory, logistical, and cultural hurdles, and leverages the "country brand" for trust and recognition. It's the leap from regional success to global impact, ensuring authenticity endures at scale (Martínez Pereira, 2025c).

6. Discussion and Conclusions

The foregoing discussion establishes endemic innovation as a compelling paradigm for innovation-driven development, especially suited to the Global South's context. This model challenges the traditional innovation playbook and offers practical guidance to managers and policymakers striving for sustainability and inclusion. This final section highlights how the endemic innovation approach advances broader development goals like the SDGs.

6.1. Implications for Firms and Organisational Leaders

For companies, entrepreneurs, and innovation managers, endemic innovation calls for a mindset shift and specific strategic actions:

6.1.1. Identify and Leverage Distinctive Attributes

Managers should start by deeply diagnosing their immediate environment's unique resources and capabilities – be it regional natural endowments or cultural know-how. Rather than always looking to imported ideas, ask what local strengths can be turned into innovations. *For example*, a food processing firm in West Africa might recognise an indigenous crop with exceptional nutritional properties and focus R&D on it, instead of producing generic imported foods. By capitalising on such distinctive local attributes, firms can develop value propositions that competitors from other regions *cannot easily replicate*.

6.1.2. Co-create with Local Communities

Endemic innovation works best as a participatory process. Companies should actively involve local communities, producers, or users in the design and development of the innovation. This co-creation taps into local knowledge (improving the solution) and builds local ownership and social acceptance. It creates a virtuous cycle: the community benefits from the innovation (jobs, income, empowerment) and supports and sustains it. Example: A pharmaceutical company developing drugs from rainforest plants should engage indigenous healers and ensure benefit-sharing with their communities; this way, the product is culturally respectful and the community becomes a guardian of the resource.

6.1.3. Build Dynamic Capabilities for Synergy

As learned, local uniqueness alone is not enough; the best firms will pair it with world-class technology and practices. This means investing in your team's learning (send engineers to get exposure to global best practices) and forging partnerships (maybe a tech licensing deal or a joint research project). Always ask: *What external knowledge could amplify our local innovation?* Managers must foster an organisational culture that is open to outside ideas and skilled at blending them with local operations. This agility – a dynamic capability – will help the firm continuously innovate around its endemic base.

6.1.4. Plan for Scaling Early

Even while focusing locally, keep an eye on global applicability. Design with scalability in mind: modular processes, quality standards that meet international benchmarks, and a long-term vision for reaching broader markets. Many startups in developing countries fail to scale because they do not plan for the complexities of growth (capital needs, regulatory hurdles abroad, etc.). Savvy managers will, from early on, build relationships that can later aid expansion (e.g., connect with international networks, NGOs, or multinational companies interested in your field). At the same time, maintain what makes your innovation authentic as you grow – do not compromise core values for the sake of quick scale, or you might lose the very differentiation that gave you an advantage in the first place.

6.2. Implications for Public Policy Makers

Governments and development agencies play an indispensable role in fostering endemic innovation. To enable and accelerate this model, policymakers can:

6.2.1. Cultivate Innovation Ecosystems around Endemic Resources

This involves careful mapping of the territory and targeted support such as research funding, incubators, and public-private partnerships focused on areas of endemic strength. For instance, a country with rich biodiversity should fund bioprospecting research centres, sponsor startup accelerators for bio-based businesses, and perhaps provide tax incentives for companies developing products from native resources. By doing so, the government derisks the initial stages and creates a pipeline of endemic innovation projects. Likewise, building physical infrastructure (e.g., science parks, innovation hubs, special economic zones) in regions rich in a particular resource can cluster activity and talent there.

6.2.2. Invest in Specialised Education and Human Capital

Policymakers should integrate education curricula that celebrate and build skills in local heritage and knowledge systems. At the university level, promoting interdisciplinary programs (combining, say, anthropology with engineering, or environmental science with entrepreneurship) can train a generation of innovators who are both globally informed and locally grounded. Technical training programs can upskill workers in relevant areas (e.g., training villagers in processing techniques for an endemic crop, or training engineers in geothermal technology in volcanic regions). The goal is to avoid the brain drain of local knowledge and instead formalise and enhance it with scientific understanding. For example, Peru has introduced gastronomy and hospitality programs that teach modern cuisine *and*

Peruvian culinary heritage, feeding the "endemic gastronomy" boom. Similarly, some African nations have started to include local herbal medicine knowledge in pharmacy programs.

6.2.3. Address Institutional Voids and Provide Enabling Regulation

Governments must ensure that regulatory and institutional support exists for innovations. This might mean updating laws, for instance, allowing community enterprises to have IP rights over traditional knowledge, or creating legal frameworks for benefit-sharing as under the Nagoya Protocol on genetic resources (Greiber, 2012). Streamlined procedures for startups, better contract enforcement, anti-corruption measures, and improvements in ease of doing business all encourage entrepreneurs to leap over endemic ideas. Moreover, the state can temporarily fill the gap where market institutions are missing. For example, if venture capital is absent, the state could provide seed funds or encourage development banks to step in. If standards/certifications are needed (like organic labels or a Manuka honey standard), the government can convene stakeholders to establish those, giving credibility to the innovation.

6.2.4. Promote Internationalisation and "Country Brand"

Governments of developing countries should actively promote their nations' unique innovations abroad. This can be via trade missions focusing on sectors of endemic innovations (e.g., Ghana showcasing its cocoa-based innovations beyond just beans). Diplomatic channels can help reduce entry barriers for these niche products. Some countries create export grants or marketing support for companies taking indigenous innovations overseas. *Country branding* is also essential: policymakers can shift global perceptions by aligning national identity with innovation (not just commodities or tourism). When people think of Iceland now, they think of renewable energy, not just fish and tourism, partly due to how Iceland chose to brand and export its geothermal success. Such branding also inspires domestic pride and youth interest in innovation fields.

6.2.5. Linking to Sustainable Development Goals (SDGs) and Inclusive Innovation

Endemic innovation inherently aligns with many SDGs. Focusing on local sustainable solutions to local problems promotes SDG 9 (Industry, Innovation and Infrastructure) and SDG 8 (Decent Work and Economic Growth) through new industries. Many case examples directly address Climate Action (SDG 13) and Responsible Consumption/Production (SDG 12) by creating eco-friendly alternatives to polluting products (For example, Bloom's algae-based biomaterials, Spora's mycelium-based leather, or Woamy's cellulose-based biofoam instead of plastic). Because endemic innovations value biodiversity and ecosystems, they contribute to SDGs 15 (Life on Land) and 14 (Life Below Water) for those dealing with marine resources.

Inclusive innovation literature often involves those at the "bottom of the pyramid" as consumers or producers. Endemic innovation provides a concrete approach by starting with local contexts, often characterised by those communities. It ensures inclusion not as an afterthought, but as a foundational element, since the idea itself arises from the community's

environment or heritage, the community has a natural role in its development. Thus, endemic innovation could be seen as a subset of inclusive innovation that leverages local uniqueness.

7. Conclusion

Towards Sustainable and Equitable Development

Ultimately, endemic innovation promises that it offers developing countries a development path that is *home-grown, sustainable, and resilient*. Countries can create industries rooted in their territories rather than depending entirely on foreign technology or exporting unprocessed commodities. This fosters a form of development that is more equitable: value addition happens locally, benefits are shared more broadly, and cultural and natural heritage are preserved and celebrated instead of being eroded by homogenization. In an era where globalisation has sometimes marginalised developing regions as raw material suppliers or low-cost labour pools, endemic innovation repositions them as sources of unique solutions and knowledge. This can gradually shift global economic structures, diversifying where innovation comes from.

There is also a geopolitical dimension: countries with strong endemic innovation success can redefine their international standing. Consider how South Korea and Japan in the late 20th century leveraged unique approaches (like Japan's automotive techniques, or Korea's state-driven chaebol model) to become innovation leaders – those were context-specific strategies turned into global competitiveness. Endemic innovation provides a framework for the next wave of countries (in Africa, Latin America, South/Southeast Asia) to do something analogous, emphasizing sustainability that earlier models lacked.

In conclusion, Endemic Innovation expands the horizons of innovation theory and practice. It demonstrates that valuable innovation can originate in any region, not just the traditional tech hubs, as long as one knows how to harness the "DNA of place". This model enriches the innovation taxonomy with new constructs – it pushes scholars to examine how geography, ecology, and culture interplay with technology and markets in creating competitive advantage. It also feeds the debate on globalisation vs. localisation: it suggests a synthesis where globalisation of markets can go hand-in-hand with localisation of innovation origins. Instead of seeing local adaptation as a minor tweak of global innovation, it flips the script to see international expansion as a careful scaling of local innovation.

From a managerial perspective, endemic innovation is a strategic paradigm: it urges leaders to look inward (to local strengths) as well as outward (to global opportunities), to think long-term about capability building, and to align profit goals with purpose (since solving local problems and uplifting communities can go hand in hand with creating lucrative products). From a policy perspective, it offers a development strategy that is self-reliant and sustainable, in contrast to methods that depend on foreign direct investment, chasing cheap labour, or on exhaustible resources.

In a world facing climate change, biodiversity loss, and persistent inequalities, leveraging local uniqueness to drive innovation offers a hopeful pathway. It inherently promotes diversity in

innovation – just as biodiversity is now seen as crucial for ecological resilience, we might see "innovation diversity" as critical for economic and social resilience. Endemic innovation ensures that we are not putting all our eggs in one basket of standardized technology, but rather exploring many baskets – each region contributing its best, in its way, to our collective future.

Funding Statement: "The author received no specific funding for this research."

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Data availability

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Ethical approval

This study does not need ethical approval statements. This article does not contain any studies with human participants performed by any of the authors.

Informed consent

This study does not need informed consent statements. This article does not contain any studies with human participants performed by any of the authors.

Figures

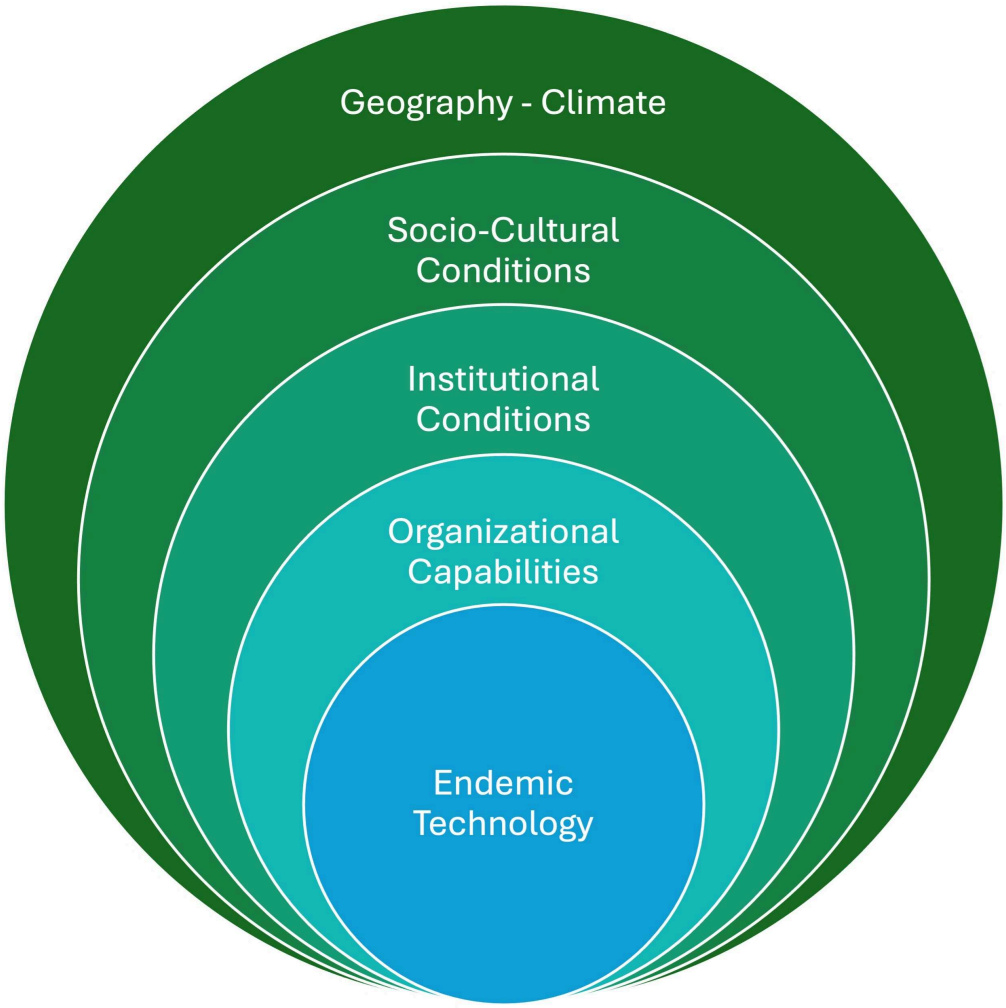

Figure 0

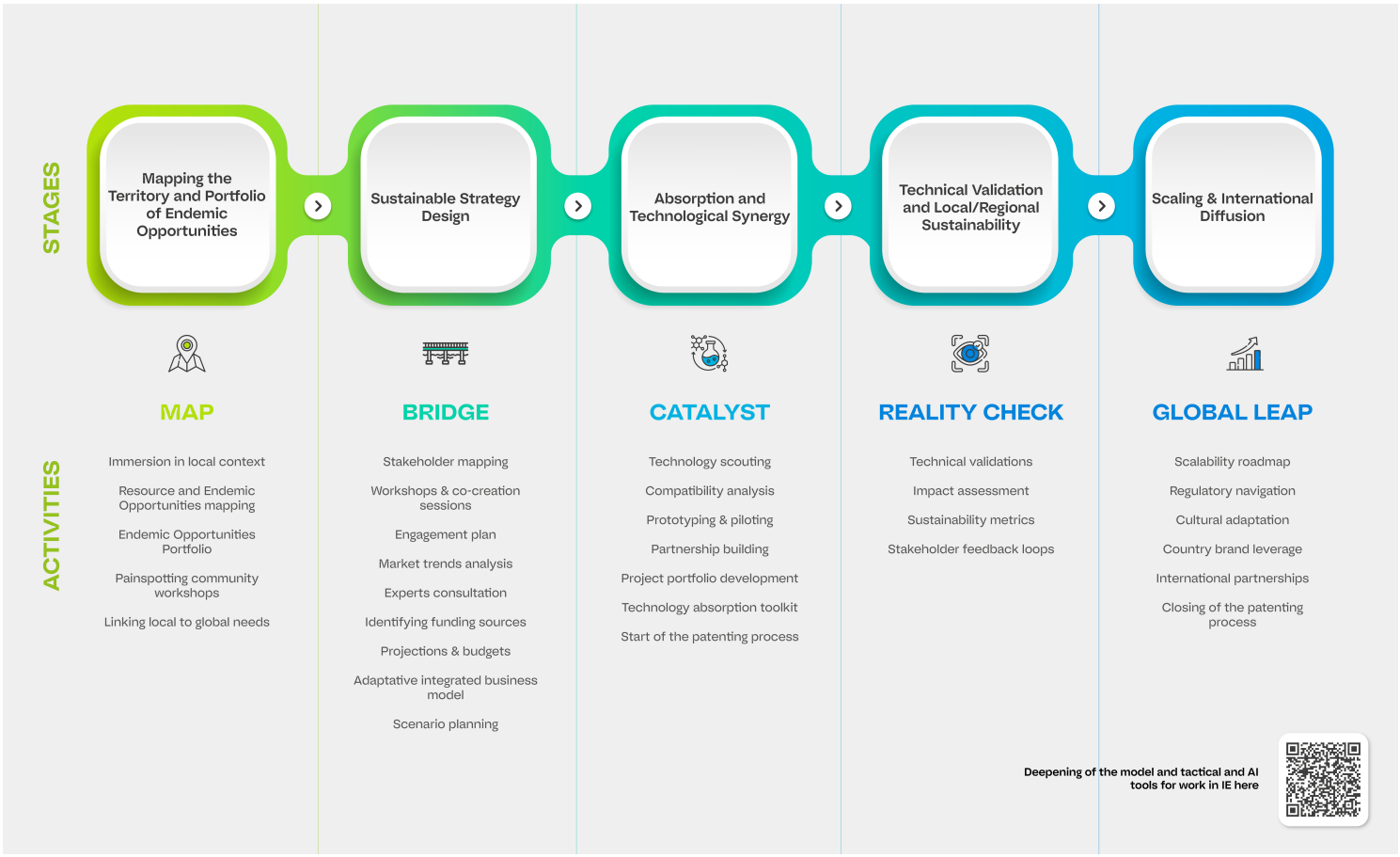
STAGES
Mapping the Territory and Portfolio of Endemic Opportunities
Sustainable Strategy Design
Absorption and Technological Synergy
Technical Validation and Local/Regional Sustainability
Scaling & International Diffusion
ACTIVITIES
MAP
Immersion in local context
Resource and Endemic Opportunities mapping
Endemic Opportunities Portfolio
Painspotting community workshops
Linking local to global needs
BRIDGE
Stakeholder mapping
Workshops & co-creation sessions
Engagement plan
Market trends analysis
Experts consultation
Identifying funding sources
Projections & budgets
Adaptative integrated business model
Scenario planning
CATALYST
Technology scouting
Compatibility analysis
Prototyping & piloting
Partnership building
Project portfolio development
Technology absorption toolkit
Start of the patenting process
REALITY CHECK
Technical validations
Impact assessment
Sustainability metrics
Stakeholder feedback loops
GLOBAL LEAP
Scalability roadmap
Regulatory navigation
Cultural adaptation
Country brand leverage
International partnerships
Closing of the patenting process
Deepening of the model and tactical and AI tools for work in IE here

Figure 1