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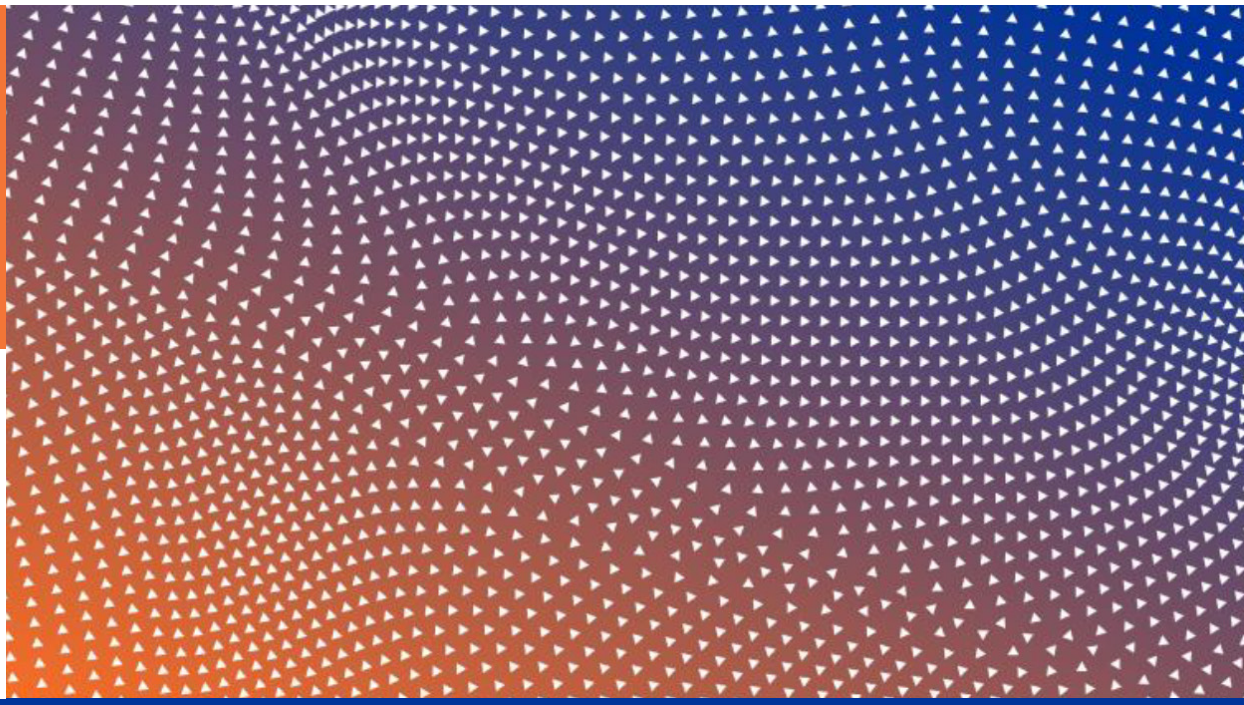

Accelerating twin transitions in Senegal

by Dr. Milou Derks, Esther Mooiman, Jelle van Balen, Modou Fall and Maria Tamara Lozano

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Executive summary

Introduction

This paper sheds light on current realities -moving beyond the speculative "coulds," "shoulds," and "might-be's" that characterise much of the twin transition discourse in African contexts. It sets out to explore an urgent and under-researched question: How do digital and green transitions interact in Africa, particularly in sectors like agriculture, waste management, and small-scale renewable energy? As the first in a three-part series (with Kenya and Mozambique to follow), this study focuses on Senegal —a country rich in entrepreneurial activity yet still no strong evidence of completed digital and green transitions. No digital innovation has yet entirely displaced the business as usual of unsustainable practices. Instead, we observe early signals of change where digital and green innovations are being adopted by multiple businesses, that are beginning to scale. These so-called in-transition cases fit into the take-off phase in the longer arc of systemic transformation characterised by predevelopment, take-off, acceleration and stabilisation (see section 2.1). Our refined research question therefore asks: Given the extensive entrepreneurial support landscape in Senegal, why have digital and green innovations —despite growing activity — not achieved to shift dominant unsustainable practices and trigger broader systemic change? Guided by one of the most established transition frameworks - the Multi-Level Perspective (MLP) (section 2.1) - we were able to identify barriers to transition at scale for eight in-transition cases and the ecosystems surrounding them. MLP helped analyse how niche innovations interact with dominant business as usual practices and are shaped by broader macro-level pressures. By combining empirical case studies with ecosystem-level interviews (section 2.2), we offer grounded insights into how twin transitions start, what barriers are preventing progress and how support systems might be improved to drive these innovations towards a transition. This paper deliberately focuses on entrepreneurship support dynamics within Senegal. We examine programmes that target entrepreneurship rather than providing a full review of sectoral non-entrepreneurship programmes in agriculture, waste, or energy. We make this choice because most innovations emerge bottom-up through entrepreneurs; our aim is therefore to advise development partners on how entrepreneurship support can better catalyse digital-green transitions.

Starting from entrepreneurial reality: a closer look at digital and green niche innovations gaining ground in Senegal

To better understand what enables or constrains progress beyond the take-off phase, 16 interviews were conducted with businesses actively delivering these eight in-transition innovations. In agriculture and energy, we found that innovations were typically being delivered by small and medium-sized enterprises (SMEs) for whom the innovation is central to their business model —such as solar irrigation, satellite advisory, or solar-powered mobility. In contrast, in the waste sector, innovation was primarily being delivered by larger companies or public-private initiatives, reflecting the capital-intensive and regulated nature of waste

management services, where it is more difficult for small innovators to gain a foothold or scale incrementally. Despite this diversity, entrepreneurs across sectors shared common reflections on what helped them scale to their current stage. Key enablers included access to early (debt or grant) funding, technical partnerships (often with international actors), and inclusion in incubation or acceleration programmes that provided visibility and market access. In some cases, partnerships with public or private actors (such as banks or NGOs) were crucial in reaching underserved markets or in navigating complex regulatory environments. Several businesses noted that having a clear value proposition-such as reducing costs or improving efficiency-was key to generating early sales. However, many also found that the end users who benefit most are not always the ones able to pay for the solution. Especially in low-income settings, there is often a gap between who uses the product, who values it, and who can actually pay, making it harder to convert value into revenue without external financing or business to business to customer (B2B2C) models.

At the same time, the entrepreneurs highlighted four critical barriers preventing their business from growing (see Section 3.2). First, access to R&D finance and technical expertise is scarce. Most financing programmes prioritise revenue growth over iterative product refinement, yet digital and green innovations often require deep technical adaptation to local contexts. Second, limited access to appropriate financing instruments-whether to fund equipment, inventory, or operations-remains a major constraint. Even for businesses with signed contracts or clear payback models, most banks are unwilling to provide debt financing. Banks reported that when dealing with unfamiliar technologies, they lack the tools to risk assess them appropriately, and can thus not provide debt financing. Third, many innovations face a misalignment between who uses and who pays when. For example, solar irrigation benefits farmers, but requires financing mechanisms that bridge seasonal income cycles. Fourth, market distortion by free or subsidised development partner/government programmes undermines willingness to pay, particularly in agriculture and energy. These and other cross-cutting challenges are summarised in the ecosystem challenge matrix presented in **Table 3**, Section 3.2.

Entrepreneurial ecosystem support: inadvertently failing to drive intended change?

Senegal stands out in the region for its ambitious digital and innovation policy agenda, including the New Deal for Technology 2050. This strategy aims to position the country as a digital hub through investments in connectivity, and support for digital entrepreneurship. In parallel, Senegal has adopted a range of green development strategies, particularly in renewable energy and sustainable agriculture. Nonetheless, with policy frameworks advancing, challenges in implementation remain. Coordination across ministries is challenging, rural regions still face gaps in digital infrastructure, and several public initiatives remain siloed, making it difficult to translate high-level ambition into coherent action on the ground (see Section 4.1). Senegal's entrepreneurial ecosystem (EE) plays a crucial role in enabling early-stage innovation and creating the conditions for potential twin transitions. The EE, mainly financed by development partners and the public sector, includes a growing number of incubators, accelerators, and funders that function as

protected spaces for digital and green innovators. These actors provide early-stage businesses with a buffer, mitigating full market exposure while commonly offering a combination of training, seed funding, mentoring, access to networks, and basic infrastructure. At the same time, development partners operate as landscape-level actors, exerting pressure on the regime through their funding decisions and narrative framing. Most entrepreneurship support in Senegal is financed by bilateral or multilateral development partners, who set the thematic agenda, prioritising digital and green innovation in line with the global Sustainable Development Goals (SDGs).

More than half of the sixteen businesses we interviewed indicated they had received some form of entrepreneurship support, and all reported it as helpful in their early development-especially in gaining credibility, refining business models, and accessing initial funding. However, each business also noted limitations in the relevance, depth, or timing of the support. Echoing this, ecosystem actors themselves-such as ESOs, financiers, and development partners-expressed critical views on the design and delivery of current support programmes. Many noted that short funding cycles, development partner-driven KPIs, and a lack of technical depth undermine the long-term viability and impact of the services provided. These concerns converged around five systemic barriers that are currently preventing the entrepreneurial ecosystem from stimulating digital and green transitions at scale (discussed in detail in Section 4.2).

First:

Many support programmes come with rigid conditions-such as mandatory founder attendance for training tied to grant eligibility-regardless of content relevance. Applications are time-consuming and the funding amounts small, leading many existing businesses to view these programmes as distracting rather than enabling, limiting the participation of existing businesses.

Second:

Senegal's EE hosts a high concentration of development partner-funded incubation programmes, designed to support existing entrepreneurs to grow, that have strict participant number targets. Yet there are too few growth-ready entrepreneurs willing to participate, so as a result, many programmes admit aspirational entrepreneurs still at the idea or prototype stage-despite content being geared toward more advanced entrepreneurs. This mismatch results in less effective support, where training meant for existing businesses are offered to early-stage entrepreneurs. The existence of many similar incubation programs and the need for each of them to achieve their participant targets, creates an environment where there is insufficient critical assessment on entrepreneurs' ideas and business models. Entrepreneurs often receive repeated praise without refining their product through engaging real users and focussing on sales, leading to recycled ideas and stalled innovation. It also leads to entrepreneurs hopping from programme to programme.

Third:

Post-incubation support is scarce. Businesses ready for the growth stage -particularly those in digital or green sectors - struggle to find tailored acceleration and technical support, or mid-sized financing in the $50k–$500k range. Existing offers are often generic and short-term, leaving promising businesses without the tools or capital necessary to scale.

Fourth:

Although government has ambitions on digital and green and see a clear role for the private sector in digital transformation, it remains challenging to coordinate entrepreneurship initiatives across ministries, without creating overlap. Rather than reinforcing the ecosystem, this lack of alignment spreads resources thin and reduces effectiveness.

Fifth:

The development partner–ESO model prioritises scale over substance. Programmes are designed around performance indicators of the development partner - often focused on participant numbers - leaving little room for tailored, in-depth support. Long-term support, expert mentoring and technical guidance are rarely integrated, disregarding the actual needs of businesses. This emphasis limits the ecosystem's ability to support transformative innovation at scale.

Conclusion and recommendations

Our research finds that Senegal's digital and green transitions are underway, considering the amount of businesses that engage in digital and green innovation, albeit in their early stages. While early-stage innovation is thriving—a result of a vibrant, public and development partner-financed entrepreneurial ecosystem—few innovations advance beyond the take-off phase. Acceleration is difficult to achieve, as illustrated by the innovations studied, meaning that dominant practices are not yet disrupted and sector-wide changes not yet made. The entrepreneurial ecosystem excels at predevelopment support but struggles to help businesses grow, scale, and gain lasting market traction. To move these innovations beyond niche activity, support must therefore also evolve-offering tailored assistance, mid-sized suitable finance, and a pooled market power. Equally important is government action: next to introducing high-level innovation support strategies (e.g. tax incentives for early-stage businesses), governments can use procurement, subsidy reform, and sector-specific regulation to create real incentives for sustainable solutions to outcompete the business as usual. Naturally, this means development partners must shift from only seeding new ideas to sustaining sector-wide scale. Without these changes, innovations remain stuck in protected spaces—visible, but unable to reshape the mainstream.

1 Introduction

This paper is the first in a series of three, and explores how digital and green transitions are unfolding in Senegal, Kenya and Mozambique. The urgency of these transitions is clear: the climate crisis is accelerating, and decades of industrial growth in the Global North has resulted in a steep environmental cost. The earth is exceeding seven of its nine planetary boundaries, with climate change, resource depletion, and pollution now posing existential threats (IPCC, 2018). Despite this, the African continent, home to roughly 15% of the global population, accounts for just 3–4% of global greenhouse gas emissions. Its contribution to the problem is minimal, but its exposure to the consequences is massive. So why should greening the economy be prioritised by African countries? The answer lies not in historical guilt, but in future potential. Africa is not just a climate victim—it is also a climate actor. Rapid population growth, urbanisation, and technological uptake mean that decisions made today will shape its developmental trajectory for decades (International Monetary Fund [IMF], 2024). Greening in this context is not about making up for past emissions, but about charting a sustainable and resilient path forward. It's about ensuring that the next wave of growth is future-proof. This is where the concept of the twin transition comes in: the simultaneous shift toward digitalisation and environmental sustainability (Tabares, Parida & Chirumalla 2025). In theory, this dual transition offers a win-win: digital tools to accelerate green outcomes, and green values to shape the design of digital infrastructure. Phenomena such as "digitalising green" – using AI, IoT, data, sensors to accelerate environmental goals - and "greening digital" - reducing the ecological footprint of digital systems - are gaining traction globally.

Simultaneously, the promise of the twin transition in Africa is compelling. In some sectors, digital solutions are already changing the game. For example, off-grid solar systems paired with mobile payments are delivering clean power to rural households across Africa (Tony Blair Institute for Global Change [TBI], 2021). Here, digital tools are used to offer practical, scalable solutions that create environmental sustainability while improving livelihoods. But they are still the exception, not the norm. The current discourse on twin transitions in Africa seems to rely heavily on aspirational language: "could," "might," "has the potential to" (Bianchini et al., 2023; Sarabdeen et al., 2024). There is a striking lack of grounded, Africa-specific research. There are no peer-reviewed academic articles focused on twin transitions in Africa, and most of the global literature, while insightful, is based on potential impact and assumptions that are not grounded in practice and reality. This raises a key risk: that (development partner) strategy will race ahead of reality. At the same time, African scholars and policymakers have voiced growing frustration with the external pressure to prioritise sustainability when poverty, unemployment, and basic services remain urgent daily concerns. This is not a rejection of sustainability-it's a call for a more just and grounded approach. Twin transitions in Africa must be about resilience and opportunity, not compliance with external agendas. A completed transition occurs when sustainable alternatives have not only emerged but have supplanted existing unsustainable practices and become the new business as usual (Geels, 2002). In the context of twin transitions, this means that green innovations

are not only the new normal, but that digital tools have played a catalytic role in accelerating this shift. In Senegal, we observed a paradox: despite an abundance of entrepreneurial support, there are no completed twin transitions. There are promising initiatives and businesses adopting innovations, yet they remain fragmented: no sector-wide transformations have taken place in which digital solutions have helped drive the widespread adoption of sustainable practices. This paper investigates why – regardless of the amount of support provided – there is no completed transition identifiable. The paper focusses on three sectors: agriculture, waste management, and small-scale renewable energy (including e-mobility). We start from identifying digital and green innovations actively advancing sustainability objectives in the three target sectors mentioned, along with the businesses that are adopting and delivering these solutions. We analyse what works, what hinders growth and what needs to change to accelerate transformation at scale.

This research is part of a broader Team Europe initiative, the Digital 4 Development (D4D) Hub, a platform where EU member states collaborate with local partners to advance digital and green transitions worldwide. This paper is not about selling a vision-it's about stress-testing it. What follows is not a theoretical discussion of what could happen, but an evidence-based analysis of what is happening-and what needs to happen next. Accordingly, our analytical emphasis is on how entrepreneurial support is designed and delivered, while we cover sectoral programmes only insofar as they shape entrepreneurial realities. This scope reflects two motivations: (1) many impactful innovations in African contexts originate bottom-up from entrepreneurs; and (2) the primary audience for this paper is those seeking actionable guidance to accelerate transitions via entrepreneurship support. We ask:

- → Where are-early phases of-twin transitions already occurring in Senegal, and what does it look like in practice?
- → What barriers are limiting its scale and advancement?
- → How can policymakers, funders and other ecosystem actors better support just and meaningful twin transitions in Senegal?

Ultimately, this three-part paper series aims to bridge the gap between policy ambition and local reality. By doing so, we hope to contribute to more effective and context-sensitive support for digital and green innovations in Africa.

2 Background and research design

2.1 Theoretical background

The field of transition studies has developed several frameworks to analyse large-scale sustainability transitions. Central among these are the Multi-Level Perspective (MLP), Transition Management (TM), Strategic Niche Management (SNM), and Technological Innovation Systems (TIS). These frameworks were originally developed in- and for high-income countries, but with the right contextual adaptation, they can still provide useful insights when applied to African settings-often characterised by informal economies, fragmented institutions, and rapidly evolving digital landscapes. The main analytical lens is the MLP, as one of the most widely used frameworks to study how sustainability transitions unfold over time (Geels, 2002). It conceptualises transitions as the result of interactions between three analytical levels:

- → **Niches** are protected spaces-such as experimental initiatives, or early-stage markets-where innovations can develop outside the pressures of dominant systems.
- → **Regimes** represent the dominant ways of doing things: the prevailing technologies, infrastructures, policies, user practices, and business models that shape how a sector operates – i.e. the business as usual.
- → **Landscape** refers to broader structural trends and external pressures-such as climate change, policy environment, urbanisation, development partner agendas, or demographic shifts-that influence both niches and regimes but cannot be easily altered by them.

According to MLP, transitions occur when niche innovations gain maturity and momentum, often supported by ecosystem actors, and begin to challenge or destabilise the dominant regime. This process is usually accelerated by landscape-level developments that create windows of opportunity for new solutions to break through. See figure 1 for a visualisation of this process. In box 1, an example illustrates that transitions are not ignited by one business alone, but through many businesses and organisations converging around a viable innovation, supported by an enabling ecosystem and shaped by wider societal and structural forces. The MLP helps us see how innovations may gradually scale, align with broader landscape shifts and eventually reconfigure the system.

Box 1: the transition towards clean cooking

A clear example is the ongoing-but incomplete-transition in the clean cooking sector in sub-Saharan Africa. Here, the regime consists of entrenched practices centered around biomass fuels (wood, charcoal) and inefficient stoves, supported by informal fuel markets, established user habits, and underinvestment in alternatives. These practices persist, despite health and environmental concerns. Over the past two decades, numerous actors -SMEs, NGOs, public initiatives -have been experimenting in niche spaces with cleaner alternatives, testing different business models, technologies, and distribution approaches. Think of electric cooking solutions powered by solar mini-grids and pay-as-you-go induction stoves. Over time, the sector has seen convergence around several viable design constellations-LPG with micro-distribution and smart metering, and solar-powered electric cooking bundled with digital payment systems. Yet no single organisation has "caused" the transition. Instead, the momentum comes from a growing number of businesses adopting and adapting these solutions, supported by ecosystem players like funders, incubators/accelerators, regulators, and technical assistance providers that shield them from full market competition. At the landscape level, pressures such as global climate policy, deforestation concerns, health advocacy, and the expansion of digital and energy infrastructure creates an environment more favourable to clean cooking alternatives. Yet, the regime has not been fully displaced. Despite progress, clean cooking solutions remain inaccessible or unaffordable for large segments of the population, and biomass fuel remains the dominant cooking practice.

Very little empirical research has been done to understand how twin transitions actually emerge and unfold in Africa. Although promising businesses are frequently highlighted in grey literature and news outlets, these examples typically represent individual business success stories rather than evidence of sector-wide change. Meanwhile, academic research largely ignores twin transitions in Africa. Most studies on digital and green in Africa focus on single innovations or businesses, not on transitions at the sectoral level - this gap motivates our study.

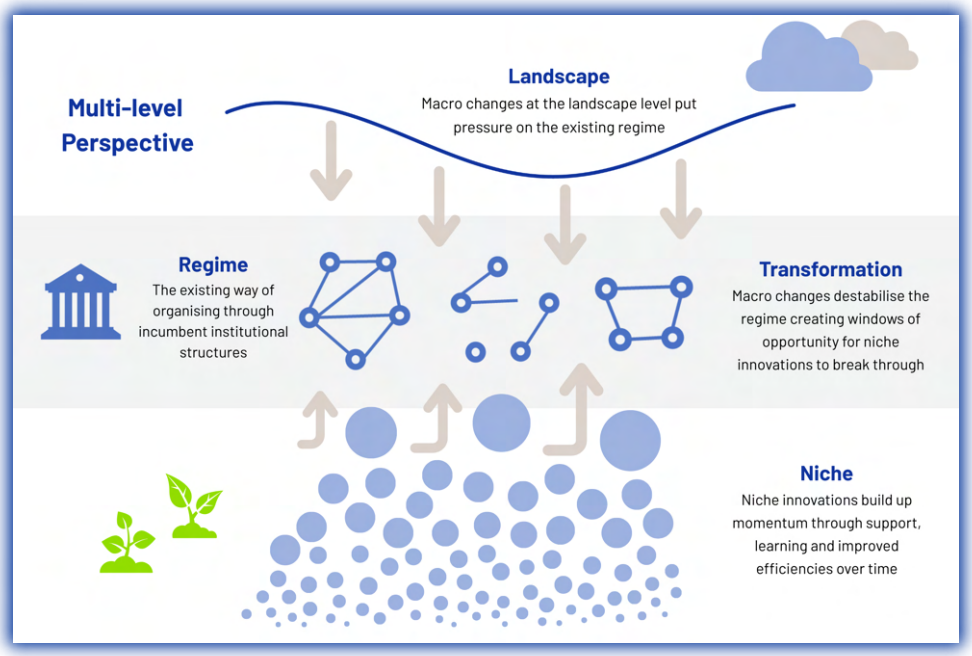

Figure 1: Adapted from the Multi-Level Perspective (MLP) framework by Geels (2002), illustrating transitions through interactions between niche innovations, regimes, and landscape pressures. Adaptation by the authors.

2.2 Research design

This paper investigates how twin transitions are taking shape in Senegal, with a specific focus on agriculture, waste management, and small-scale renewable energy (including e-mobility). These are sectors where sustainability challenges are acute and where digital technologies offer real leverage for change. The overarching research question guiding the full series is: ***"How do digital and green transitions interact in emerging economies, particularly in sectors like agriculture, waste management, and small-scale renewable energy?"***

In this paper, we narrowed the scope of inquiry based on preliminary literature review and six exploratory interviews with development partners and investors. These revealed an apparent paradox: Senegal has a dense landscape of support for entrepreneurs with numerous development partner-funded incubation programmes and early-stage grant schemes. Nonetheless, we found only a handful of examples of innovations that could be considered in-transition[1], and no clear cases of completed transitions. This led to a more specific research question: ***"Given the extensive entrepreneurial support offered in Senegal, why have digital and green innovations so far struggled to shift dominant practices and trigger broader systemic change?"***

1 We define in-transition using the four-phase model of socio-technical transitions from Schot and Geels (2008), distinguishing between pre-development (where niche innovations are marginal and the dominant regime is stable), take-off (where innovations begin to stabilise, attract support, and interact with the regime), acceleration (where innovations diffuse more widely and regime structures begin to erode), and stabilisation (where a new regime consolidates). We define the in-transition phase as beginning from the take-off phase onwards—that is, when innovations show early momentum and ecosystem interaction—because this is when potential systemic change becomes visible. In our case, we observe growing alignment around promising innovations, early adoption, increasing support from development partners and ecosystem actors, and initial signs of tension within the dominant regime.

We centre our inquiry on entrepreneurship-focused programmes. We do not provide a comprehensive assessment of sectoral non-entrepreneurship programmes in agriculture, waste, or energy. This scoping is intentional: (i) in Senegal, as in much of Africa, innovation trajectories frequently begin bottom-up with entrepreneurs; and (ii) our objective is to generate concrete recommendations on how to redesign entrepreneurship support to unlock transition dynamics.

To address this, we explore three core themes:

1. **Innovation and scaling**
   i.e. what types of digital innovations are adopted to accelerate green outcomes? How are these innovations scaling? What barriers or tensions limit their adoption? What role do development partners, ESOs, and entrepreneurs play, and how effective are current interventions?

2. **Policy and governance**
   i.e. what policies exist to promote digital and/or green innovation? How does the policy environment enable or hinder the emergence of digital and green transitions?

3. **Tensions and trade-offs**
   i.e. what practical dilemmas do entrepreneurs and ecosystem actors face in aligning sustainability and business goals? What unintended consequences arise-such as e-waste or energy use from digital systems-and how are these being addressed?

Our research adopts a comparative case study design, focusing on cases that can be considered in-transition. We define in-transition cases as those where digital and green innovations have progressed beyond the pre-development phase, are being adopted by multiple businesses and supported by ecosystem actors-but have not yet reached the acceleration or stabilisation phases where these innovations replace "business as usual" and reconfigure dominant regime practices.

While Senegal has not yet demonstrably completed digital or green transitions in sectors such as agriculture, waste, or energy, this "in-transition" state is particularly important to study. By examining these intermediate stages of transitions, we aim to understand how transitions begin to take shape, how actors interact, and what conditions support or constrain broader system shifts. Although no cases were observed where sustainable alternatives have replaced dominant practices and stabilised as the new business as usual - we do observe promising in-transition cases.

For example, the adoption of solar-powered irrigation pumps equipped with remote sensing technology. This innovation is increasingly used by cooperatives, NGOs, and small agri-enterprises, yet traditional diesel

pumps and manual irrigation still dominate the sector. Such examples allow us to study real-time dynamics of innovation adoption and ecosystem interaction.

We identified 8 cases consisting of different digital and green innovations. Each case study centres on a specific innovation and the businesses implementing it (hereafter called "innovators"), embedded within a wider actor network. Selected cases reveal interaction across ecosystem actors, such as entrepreneurs, development partners, government agencies, financial institutions and civil society. We also interviewed 20 ecosystem actors, including development partners, NGOs, government entities, ESOs, financial institutions, and research institutions. This diverse actor set enables us to map how support systems and institutional frameworks shape transition dynamics. See **Table 1** and **2** for an overview of interviewees.

Innovators

This whitepaper draws on the experience and insights of a diverse group of innovators who are advancing Kenya's twin transition. Their hard work, determination, and insights have been central to this whitepaper, helping to highlight the realities, opportunities, and ambitions behind Kenya's digital and green future.

Table 1: Overview of innovators.

Organisations	
Sonaged	Delvic
Allcot IO	Fossetic
Ecomoto	Ibriz
Laiterie du Berger	Nadji.BI
Kranth Sarl	Nomadesoft
Tolbi	Senfrais
Jokalante	Jokosun
Be Energy	

Ecosystem actors

In addition to the innovators, this whitepaper draws on the experience and perspectives of a diverse group of ecosystem actors. Their insights have helped to illuminate the broader environment in which innovation takes place, highlighting the critical role of ecosystem support in enabling Kenya's digital and green transition.

Table 2: Overview of ecosystem actors.

Actor groups	Tools used	Data points
Entrepreneurial Support Organisations	Interviews	4
Government entities	Interviews	5
Financial institutions	Interviews	5
Development partners	Interviews	5
Research Institutions	Interviews	1
Focus Group Discussion (FGD) with 20 early-stage entrepreneurs	FGD	20
TOTAL		**40**

By focusing on these in-transition cases, the research aims to uncover why, despite extensive entrepreneurship support, so few innovations have contributed meaningfully to broader digital and green transitions. This research design allows us to explore how support mechanisms, innovation processes, and ecosystem dynamics interact-and where they may fall short-in enabling systemic change.

2.2 Research design

Senegal is a West African country of 18.9 million people, widely regarded as politically stable and economically influential in the region. Over 80% of the population resides in the western part of the country, with the capital Dakar alone accounting for around 25% of the population and over half of national GDP. The services sector dominates the economy, contributing over 50% to GDP. Industry accounts for roughly 25%, and agriculture for around 17%, although agriculture remains a major source of rural employment. Unemployment-particularly among youth and university graduates-remains high, and around 90% of workers operate in the informal economy. This duality, formal vs. informal, urban vs. rural, continues to shape economic participation and innovation trajectories across the country. When it comes to job-seekers, nearly 4 in 10 adults (ages 18–64) are actively pursuing or planning to start a business, underscoring the country's strong entrepreneurial spirit.

Senegal has demonstrated considerable ambition in both digital and green development, aiming to position the country as a digital and entrepreneurial hub in West Africa. In 2024, the country ranked 4th in the region and 92nd globally on the Global Index Report, which captures the innovation ecosystem performance of 133 economies and tracks the most recent global innovation trends. Senegal also leads in the venture capital and private equity space in Francophone West-Africa. In 2021, it ranked second after Morocco in deal volume, with 73% of VC activity concentrated in tech or tech-enabled businesses. These ventures span sectors such as fintech (33%), supply chain tech (13%), edtech (7%), and mobility tech (7%). As a backdrop, the national digital strategy, "New Deal for Technology 2050," has promoted widespread mobile connectivity, the digitisation of public services, and the growth of digital entrepreneurship. Internet penetration is relatively high by regional standards (above 80% for mobile internet), and mobile money usage has expanded rapidly, especially in urban areas. However, digital infrastructure remains uneven, with lower connectivity in rural regions and limited access to advanced digital tools outside major cities. For green development, the government has prioritised renewable energy, particularly solar, as well as sustainable agriculture and emerging circular economy models. Senegal has made notable progress in increasing the share of renewable energy in its energy mix and supports climate-smart agricultural practices through national strategies and public investment programmes. Despite these developments, integration between Senegal's digital and green agendas remains at an early stage. Initiatives are often siloed, and examples of systemic coordination between digital and environmental strategies are limited. This makes Senegal an ideal setting to study how so-called "twin transitions" begin to emerge - not as finished outcomes, but as evolving processes shaped by diverse actors, interests, and constraints.

Another driver of the digital-green agenda is the development partner community. International development partners and development agencies actively promote digital and green innovation in Senegal as part of broader strategies for climate adaptation, resilience, and inclusive economic development. There is a particular focus on youth entrepreneurship, with many programmes aiming to tackle unemployment by stimulating green job creation and supporting businesses that combine technological innovation with environmental impact. These efforts depend heavily on aspects of the surrounding entrepreneurial ecosystem, such as funding, training, infrastructure, and enabling policy.

The entrepreneurial ecosystem has seen a surge in activity, with over 25 ESOs providing incubation and pre-incubation services to more than 1000 startups each year. Notable ESOs include Concree, Impact Hub Dakar, and iGNITE.e. These actors play a central role in delivering training, mentoring, and grant programmes, and are typically contracted by development partners who fund and design the interventions.

Figure 2: Fact sheet with key indicators on digital and green transitions in Senegal. Sources: (1) World Bank, World Development Indicators (2023); (2) WIPO (2024), Global Innovation Index 2024; (3) Data Reportal, Digital 2025 – Senegal (2025); (4) UN DESA, 2020 International Trade Statistics Yearbook (2021); (5) Tracxn, Startup Landscape in Senegal (2025); (6) RVO & IANOVA, Twin-transition innovation mapping (2025); (7) ANSD, Situation Économique et Sociale, 2022–2023 (2025); (8) Data not available; (9) IANOVA & RVO estimates; (10) IANOVA estimates based on OECD Creditor Reporting data (2019–2023).

3 The entrepreneurial reality: digital and green innovations gaining ground in Senegal

Despite significant ecosystem support in Senegal–including incubators, accelerators, development partner funding, and several VC actors–completed digital and green transitions are yet to emerge. After extensive research, we identified eight cases that are in-transition: innovations that have progressed beyond the pre-development phase and are being offered by multiple businesses and adopted by multiple users, supported by ecosystem actors, and beginning to interact with established regimes. However, these innovations have not yet reached the acceleration or stabilisation phases, where they would replace dominant practices and consolidate as the new business as usual. In this section, we analyse these cases to understand each innovation, what has enabled their emergence, what is preventing them from advancing, and what this reveals about current support efforts.

3.1 Eight innovations at the edge of transition

Before sooming in on eight illustrative cases, we began by compiling a database of digital–green innovations in Senegal across agriculture, waste management, and renewable energy. This inventory was built from online desk research, our professional networks, and snowballing through interviewees. In total, we identified roughly 50 distinct initiatives, ranging from start-ups to more established SMEs. Most operate in the early stages with between 0–15 employees, while a smaller number have been active for several years and show stronger market traction. The dataset also includes both 'real businesses' with ongoing operations and more project-like initiatives driven by NGOs or public–private consortia.

Figure 3 shows the sectoral distribution of these innovations, while *Figure 4* categorises them by type of technology used (e.g. satellite and AI applications, solar-powered hardware, e-commerce platforms, or IoT-enabled services). The distribution shows that most Senegalese digital–green innovations rely on relatively accessible technologies such as mobile apps, platforms, and IoT-based tools. These solutions dominate because they are relatively low-cost, adaptable, and compatible with existing user practices. More capital-intensive or frontier technologies, such as drones, blockchain, and advanced analytics, are emerging but remain niche, reflecting both their higher technical demands and the limited financing and regulatory support available for scaling them. Together, the figures illustrate two important patterns: (1) agriculture dominates the innovation landscape, with a proliferation of start-ups targeting advisory services, input access, or irrigation solutions; and (2) digitalisation most often takes the form of mobile-based platforms and IoT applications, while more capital-intensive green technologies (such as e-mobility or waste valorisation) are less common. This innovation mapping underlines that Senegal has a growing entrepreneurial interest in linking digital tools with sustainability goals. The eight cases discussed below were selected because they represent the most advanced examples of digital–green solutions that have moved beyond isolated pilots and are beginning to show signs of scaling.

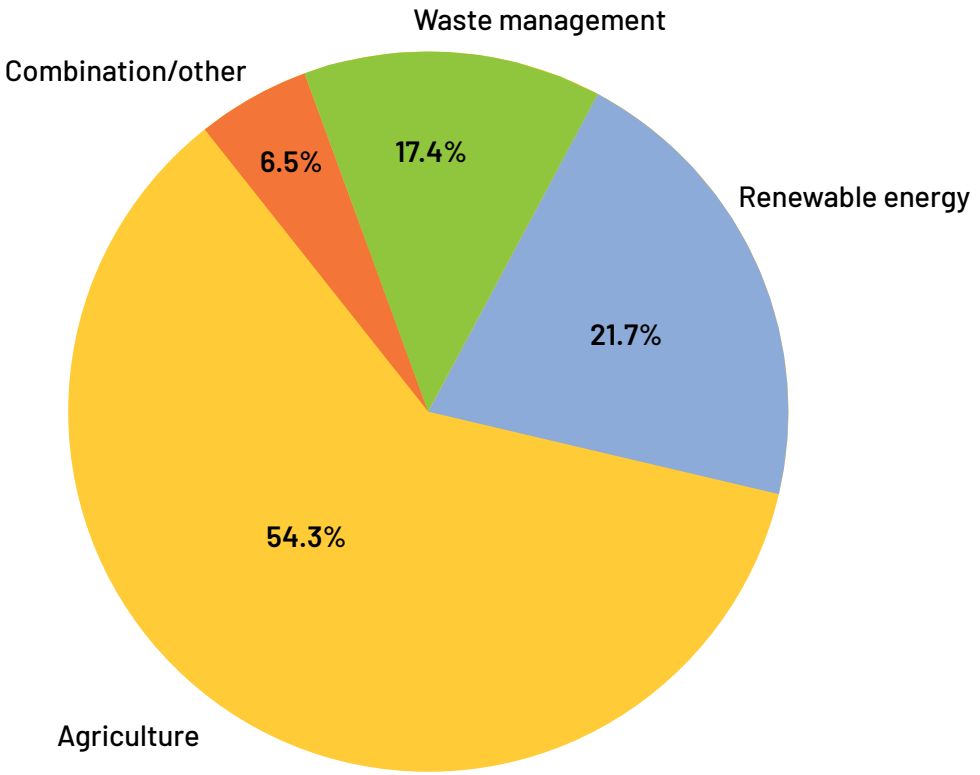

Figure 3: Distribution of digital and green innovations by sector.

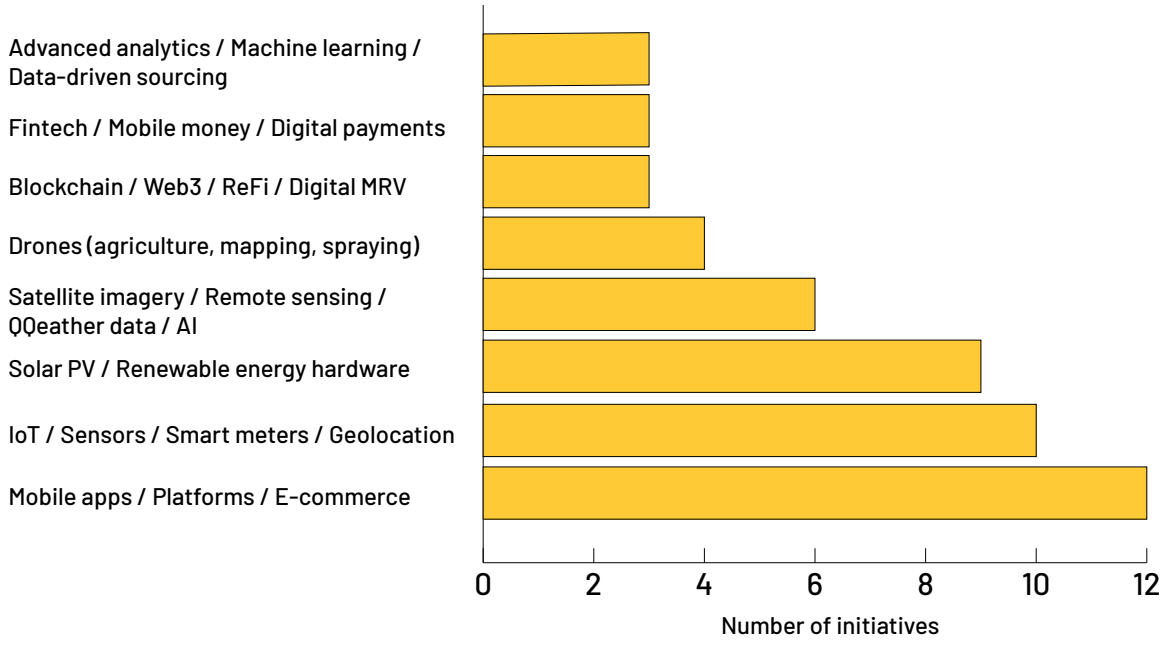

Figure 4: Distribution of digital and green innovations by technology types.

1. Solar irrigation systems

Solar irrigation replaces fossil fuel-powered pumps with solar-powered systems to reduce fuel dependency and operational costs. The core innovation lies in harnessing solar energy to drive irrigation, with companies offering varying levels of digital integration. Some systems include simple mobile app-based on/off switching (IoT), while others incorporate advanced sensor technology to automate irrigation based on soil moisture levels or time schedules. To reduce dependence on costly imported components, certain companies even design and produce their own converters locally. Innovations in payment models have also emerged, such as flexible "pay-as-you-go" or "pay-as-you-can" schemes tailored to the seasonal income patterns of farmers. A solar irrigation business noted that this flexibility has had tangible effects on outreach and usability in rural areas, where most agricultural activity takes place.

Despite these innovations, adoption remains limited due to high upfront costs of installation. While the systems generally have a payback period of 1 to 3 years, many farmers cannot afford the initial investment, and not all businesses have the cash flow to offer deferred payment options. A few have managed to partner with microfinance institutions (MFIs), banks, or development partners to pre-finance installations. However, these partnerships face their own limitations: MFIs often lack the liquidity to scale, while banks remain skeptical of the technology. One company acknowledged the funding challenge, stating that "raising sufficient funding to sustain growth is [a] big challenge... we have only secured 17% of the funding needed."

Market distortions caused by free or heavily subsidised development partner or government programmes further hinder commercial uptake. These programmes reduce farmers' willingness to pay for similar services, weakening the viability of private sector models. Although the government does not directly subsidise fossil fuel pumps, broader energy subsidies in the agriculture sector keep fuel prices artificially low, diminishing the comparative advantage of solar alternatives. As one major solar irrigation provider observed, out of an estimated 120,000 to 180,000 fossil fuel pumps in Senegal, fewer than 6,000 have been replaced with solar-powered versions-a stark illustration of the market gap. Current actors active in the Senegalese solar irrigation landscape include Ibriz, Nadji.bi, Nomadesoft, Bonergie Irrigation, and Oolu Solar.

Figure 5a: Image of the team in a field visit of innovator Ibriz and their solar pump irrigation systems.

Figure 6b: Image of the solar pumps used for Ibriz' operations

Figure 6a: Image of the team in a field visit of innovator Nadji.Bi at one of their Walalma centers. The payment of services is digital, as the customers can purchase specific Walalma points. They do this directly in the service center with a mobile account.

Figure 6b: Image of the converter inside the service center. All equipment runs on solar power, as the Walalma center has solar panels on top.

2. Satellite imagery-based advisory services to farmers

Satellite imagery-based advisory services use remote sensing and climate data to help farmers improve productivity and manage land more sustainably. These tools analyse satellite imagery to monitor crop health, soil moisture, and pest outbreaks. With this data, tailored advice can be provided to farmers on input use, irrigation, and planting times. The green component lies in optimising resource use-reducing fertiliser and pesticide overuse and improving water efficiency. The digital aspect includes satellite sensors, AI-driven analytics, mobile alerts (SMS or voice, often in local languages), and in some cases, integration with IoT soil sensors for more precise validation. Different providers take different approaches: some focus on AI-enhanced weather predictions, others prioritise simple mobile dissemination. Beyond productivity, these technologies have the potential to support wider environmental aims. As one innovator explains “we are mostly targeting smallholder farmers because they manage over 80% of the land and feed more than 90% of Africa's population.” By advising farmers based on real-time data, farmers can adopt more sustainable practices, such as reducing water usage, fertiliser and pesticide use.

Figure 7a: Image of the Jokalante team.

Figure 7b: Image of the Jokalante team.

However, challenges such as weak rural connectivity, limited smartphone penetration, and the need to translate complex data into simple, actionable advice, limit uptake. Businesses also face challenges. For example, securing financial and human resources can be difficult. Finding AI-skilled engineers is especially challenging, combined with the fact that innovating shouldn't drive up prices for farmers. Farmers themselves may (at first) distrust digital recommendations or lack the means to act on them, such as access to credit or inputs. Additionally, most satellite imagery-based advisory services currently rely on development partner funding, as ability and willingness to pay among farmers is low and government support for digital advisory is minimal. Traditional in-person advisory services remain dominant, although innovator Jokalanté is challenging this by using community radio and workshops to give advice based on their satellite data, while Tolbi uses AI to call farmers and advise them in the local language Wolof.

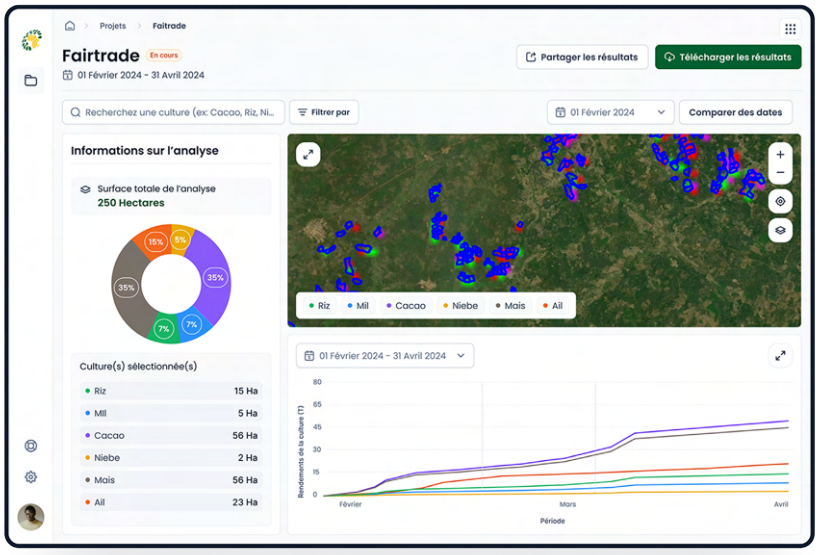

Figure 8a: Retrieved from tolbi.ai, screenshot from their digital monitoring tool.

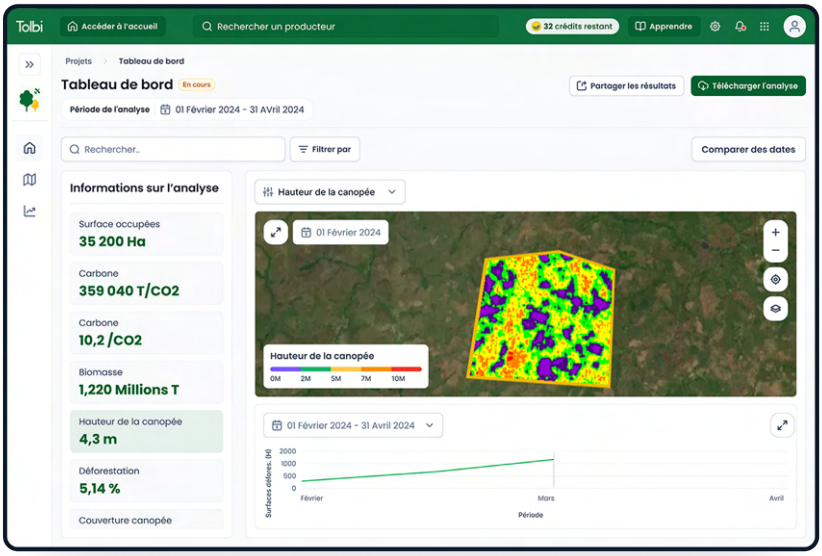

Figure 8b: Retrieved from tolbi.ai, screenshot from their digital monitoring tool.

3. Precision agriculture drones for targeted crop monitoring

Drone systems for precision agriculture are beginning to take hold in Senegal, with few businesses offering services like crop monitoring, disease detection, and targeted spraying. These businesses use drones that fly over fields to identify areas of stress, pest problems, or water needs, allowing for more precise use of water, fertilisers, and pesticides.

"We are able to find sick plants, count them, and geolocate them. Then we can spray pesticides only where needed," explains KRANTH, highlighting how precision agriculture avoids chemical use. This reduces waste, protects the soil, and supports more sustainable farming.

For KRANTH, satellite imagery is no competition, but a technology that can be complementary to the drone technology they specialise in. "We actually work together with satellite data organisations. For example, we did a project using drone and satellite imagery to build immersive 3D models." Their experience shows the potential for hybrid solutions, pairing satellites broad view with drone-level precision-to drive innovation in monitoring, inspection, and agriculture. Their openness extends to collaboration with foreign firms and development partners:



"Sometimes companies come to us to collaborate, but we don't have the right technology. If someone else does, we send them there. It's not about owning the whole market." ***- Team member KRANTH***

The innovation is both digital and green-by cutting unnecessary chemical and water use-and digital-using sensors and mapping software to gather and analyse data. However, the cost of drones and the sensors used is very high. "A high-quality thermographic sensor can cost more that the drone itself". These costs render drone services inaccessible to most small farmers. As a result, paying customers are usually governments or large agricultural companies able to invest in the technology and use it to manage larger farms more efficiently.

Additional challenges include the need for trained drone pilots and complicated regulations requiring special flight permits. "You needed authorisation for everything. The authorities were afraid... it was very much a 'no, no, no' attitude," recalls KRANTH about the early regulatory climate. Some companies, like KRANTH and Senedrone, have worked closely with aviation authorities to develop more enabling rules, yet the process remains resource-intensive and slow to scale. Additionally, the lack of local subsidies or structured government support for drone use in agriculture continues to constrain adoption.

4. Carbon credit offsetting through mangrove restoration

Carbon credit offsetting in Senegal focuses primarily on mangrove reforestation projects. These initiatives plant mangrove forests that absorb carbon dioxide over time, generating carbon credits that are to be sold on international markets. The green aspect lies in restoring coastal ecosystems and capturing carbon, while the digital side involves using satellite imagery and sensors to monitor forest health, track salt levels, and detect threats like pests or illegal logging. Monitoring is essential to verify the carbon capture accurately. The process requires close cooperation with local communities, who receive a share of the revenues. The impact is already felt by the local community with a representative reflecting that "[the community mentioned that when] we identified lands to replant, we were the only ones who didn't abandon the project- everyone before us had."

Figure 9a: Image showing the mangrove site ALLCOT.IO is working on as a carbon credit off setter.

Figure 9b: Image of volunteers planting mangroves in Senegal.

However, uncertainty remains whether communities will maintain the forests long enough to realise benefits, because "a significant portion of the carbon market revenues needs to go back to the community". A mangrove forest does not grow and offsets carbon overnight, and therefore "it takes time before a significant amount of money can be allocated [to local communities]" Government approvals and permits are difficult to obtain due to bureaucratic hurdles and limited understanding of the carbon market. "Long-term projects like this need political stability to truly flourish. If we could eliminate political risk, that would be ideal. Who would've predicted, for example, that the U.S. would shift their direction on climate". Human capacity provides also another bottleneck, as few understand the complexities and timescales involved. Besides the three main companies actively working on mangrove-based carbon offsetting, several others-including firms involved in solar irrigation and satellite imagery-are exploring entry into the carbon credit market. However, the market is demanding: generating sufficient carbon offsets requires large-scale, well-monitored projects, and carbon prices can be volatile, adding financial risk. Senegalese companies active in this area include Allcot.io.

5. Cooled transport as a service

Cooled transport as a service offers solar-powered cooled transport services for agricultural products, such as vegetables and meat, moving goods from farms, aggregators, or slaughterhouses in rural areas to markets and restaurants in more populated areas. The service uses a large solar-powered freezer that pre-freezes products, combined with several tricycles equipped with solar cooling units holding about 1000–1500 litres-making it accessible for smaller farmers. Unlike the usual method of transporting produce in ice-cooled boxes that melt quickly in Senegal's heat, this system provides more reliable temperature control, reducing food waste, spoilage and health risks. Sensors monitor temperature during transport, and cameras check door openings to prevent product loss or theft. Drivers cannot control temperature while on the move, so it's managed remotely.

The business model is based on transport-as-a-service, which includes transport and driver costs. The payback time of the tricycles is roughly 6–12 months – regardless of this relatively low payback time, the main bottleneck remains the high upfront cost of tricycles. Banks hesitate to finance the unfamiliar solar-powered tech, and large firms are often slow to adopt, preferring to "wait and see". The issue is not demand, but instead access to working capital and meaningful co-development partnerships. As explained by a representative of SenFrais "big companies don't invest in R&D and would rather wait until a solution is proven." Currently, SenFrais is the main company offering this service in Senegal.

Figure 10a: Image of the Senfrais cooled transport.

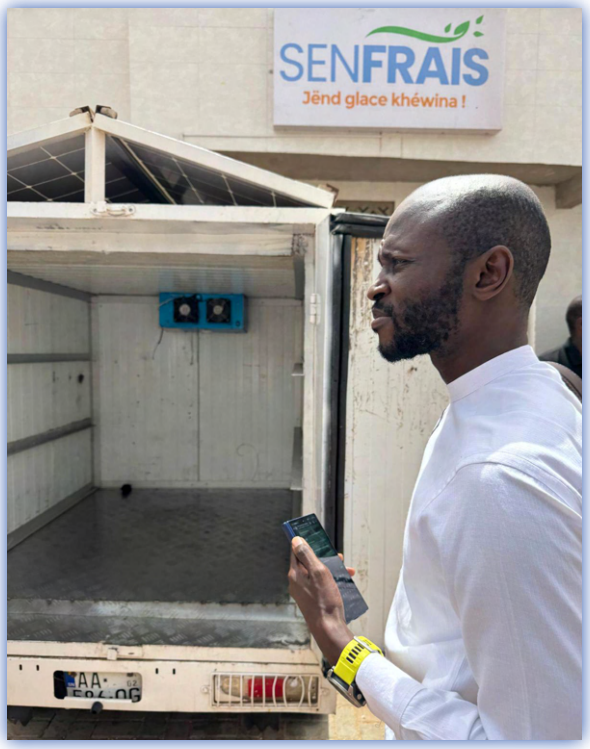

Figure 10b: Image of Senfrais cooled transport.

6. E-mobility powered by solar energy

E-mobility in Senegal is developing through solar-powered electric vehicles including cars, scooters, and boats, aiming to reduce emissions and reliance on fossil fuels. A significant focus is on retrofitting traditional boats and motorbikes with electric engines powered by batteries charged at solar energy hubs. In the case of boats, this transition helps owners cut fuel costs and emissions, supported by digital tools that track trip data and battery health. However, retrofitting requires specialised skills, which are scarce locally. Boat owners typically finance the retrofit through loans. The biggest barriers include limited government support to facilitate electric water transport, a shortage of trained technicians, and the challenge of convincing owners to switch from conventional engines.

Figure 11: Image of the traditional boats called pirogues where Jokosun is focusing on retrofitting them to run on electrical energy (courtesy of Jokosun).

On land, companies offer electric scooters and cars for rent, targeting both individuals and professional drivers with flexible payment and ownership options. These vehicles are mostly imported and come with high upfront costs, which is the main hurdle for expansion despite high user interest. Solarbox highlight the need to adapt and respond to local ecosystem factors, not everything that works abroad will succeed in African markets. "Solar is seen as the "it" factor, everyone is interested in solar, but upfront expenses still hamper widespread adoption."

Figure 12a: Retrieved from the Launch Africa website. Two blue Solarbox electric motorbikes with rear storage boxes, showing their two-wheeler transport solution made in Senegal.

Figure 12b: Retrieved from the Launch Africa website. A Solarbox three-wheeler electric vehicle with a large cargo box, representing their locally built option for transport and delivery in Africa.

Digital platforms help manage rentals and maintenance, and companies also stress that "great technology is not enough: if people won't use it, it's not worth it." Overall, e-mobility in Senegal benefits from solar energy integration, cutting emissions and costs but faces challenges related to capital investment, skills shortage, regulatory support, and affordability. Similar projects in solar-powered vehicle rentals elsewhere report difficulties in scaling due to the high capital expenditure and infrastructure needs. Current active Senegalese companies in this field include Ecomoto, Mbay Mobility, SolarBox and JokoSun.

7. Waste sector related innovation

The waste sector in Senegal is largely a public service dominated by large, often state-owned or state-funded entities responsible for waste collection and processing. Digital and green innovations in this sector remain limited. The few innovations that do exist tend to come from either larger organisations gradually adopting new technologies or from small-scale entrepreneurs experimenting with novel approaches. Financing is a key challenge since waste collection services are generally provided free of charge and rely heavily on government budgets, which are often unstable. Formal partnerships between public entities and private innovators exist but are still developing.

Interest is growing in technological solutions like satellite imagery and mobile apps to improve service delivery and reporting, but these are not yet widely integrated. Among the few emerging innovations, some small-scale companies are developing waste-to-resource systems that convert human waste into electricity, industrial water, and fertiliser using on-site sanitation technologies and omni-processors.

These approaches often bypass centralised sewage systems and incorporate digital tools to manage financial and operational flows. Another example is a sensor-based system to monitor septic tank levels, designed to prevent health risks from overflows and optimise waste collection routes by providing real-time data on tank capacity and location. Despite their potential, these innovations remain limited in scale due to difficulties in securing sufficient funding, proving their business viability, and establishing stable partnerships with government agencies, which face frequent organisational changes. Overall, these efforts highlight early steps toward sustainable and digitally enabled waste management, yet significant barriers remain for scaling. Key companies currently active in Senegal's innovative waste sector include SONAGED, Delvic and Fossetic.

Figure 13: SONAGED workers collecting waste, showing state-led services in Senegal.

Figure 14: Delvic site with waste blocks turned into usable resources.

Figure 15: Fossetic technician installing a sensor to monitor septic tanks.

8. Battery regeneration

Battery regeneration in Senegal represents a specialised innovation focused on extending battery life, reducing industrial waste, and lowering emissions. The technology, imported from France and now operational locally, allows companies-mainly large industrial clients-to reduce costs associated with frequent battery replacement. The innovation offers clear environmental benefits: "regeneration is 50 to 70 times less carbon-intensive than producing new batteries.". This precision work requires dedicated workstations equipped with digital monitoring tools to ensure safety and quality. Different companies may have variations in how they integrate these technologies, with some planning to develop fleet management systems to optimise battery use across multiple assets. Currently, the innovation is still niche, not yet mainstream, due to the highly technical nature of the process and the absence of regulatory frameworks. "Our main challenge is the lack of formalisation and comprehensive regulation within the battery recycling and regeneration sector in Senegal." The company explains that "the current decree is outdated and not effectively enforced," allowing informal collectors and scrap dealers to operate without adhering to environmental or safety standards. This has led to severe risks, including "environmental contamination from acid and lead and serious health issues for those handling batteries without protection." In the case of mishandled lithium batteries, there are also risks of "thermal runaway and dangerous explosions" in hot climates. The main Senegalese company offering battery regeneration services is Be Energy.

Figure 16a: Image showing used batteries prepared for testing and renewal as part of efforts to extend battery life and reduce waste.

Figure 16b: Image of a workstation at BeEnergy equipped with digital monitoring tools, used for the controlled regeneration of batteries to ensure safety and quality.

3.2 Key barriers to scaling digital and green innovations

Despite the promising advances represented by the eight innovations explored, none of these have yet surpassed predevelopment and take-off phases. In all innovation cases, a limited number of businesses are active and most of these businesses remain small, with the majority having around 10–20 employees. Business as usual approaches continue to dominate across sectors, and the broader system-whether in financing, regulation, supply chains, or infrastructure-is still largely optimised for conventional, often less sustainable, practices. Conversations with the businesses within these innovations, a focus group of 20 early-stage entrepreneurs, as well as over 20 ecosystem support actors revealed a dense web of barriers to growth. Some challenges are broad and apply to entrepreneurship in general, such as limited access to finance, talent shortages, and weak policy enforcement. For businesses active in digital and green innovation, these are coupled with more specific challenges, such as distrust in new technologies, high capital costs, fragmented regulatory support, and market distortions. We highlight four of them below. For an overview of all barriers reported, see **Table 3**.

(1) The necessity of R&D financing and specific technical knowledge

Research and development (R&D) is especially critical for digital and green innovation because these solutions often depend on deep, specialised domain knowledge. For instance, if a business is building an agri-advisory platform based on satellite imagery, it must integrate expertise in remote sensing, geospatial data analysis, agronomy, and local climate conditions. This is not general tech or business knowledge; it's highly contextual, technical knowledge that is currently not available within most entrepreneurship support systems like incubators or accelerators. These support structures may offer help with business modeling or pitching, but they rarely have the capacity to assist with the kind of interdisciplinary technical development required for effective digital and green solutions. Many innovators are acutely aware of the need to invest in technical knowledge, through R&D to refine their technologies and make them viable in the local context they operate in.

However, they report that this kind of capital is the hardest to find. Most available funding-whether from impact investors or development partner grants-is geared toward growth and comes with strict expectations around user numbers, revenues, or market expansion within short timeframes. This makes it poorly suited to R&D, which typically involves iterative testing, long lead times, and uncertainty. Debt financing is not a viable option either, as R&D expenditures do not generate immediate revenue to repay loans. As a result, innovators are forced to fund R&D from their own profits-an option that is largely inaccessible to early-stage or small businesses-or to chase development partner grants that still prioritise short-term growth over longer-term product development. Some entrepreneurs have attempted to fill this gap by partnering with universities, but this has proven difficult in practice. While Senegal has capable research institutions, innovators often struggle to find academic partners with the right mix of applied technical expertise and institutional flexibility. Collaborations are hampered by misaligned timelines, bureaucratic hurdles, or a

misaligned timelines, bureaucratic hurdles, or a lack of shared incentives. Without such partnerships, innovators are left to build or acquire all necessary expertise themselves, which raises costs, slows progress, and limits the potential for more ambitious innovations to emerge and scale.

(2) Access to debt financing

Even when innovators are not asking for high-risk R&D capital but for relatively straightforward loans to finance raw materials or equipment-such as solar-powered irrigation kits or cold-chain transport vehicles-access to finance remains difficult, although banks try to accommodate. . Entrepreneurs point out that many of these investments have clear returns and payback periods of 1 to 3 years. However, banks remain hesitant to lend, citing the newness and perceived riskiness of the technology, and the lack of knowledge on the technology and unclarity of business models, as key reasons to refuse loans, even when supported by signed contracts or purchase orders. The reluctance seems to stem from a limited understanding within financial institutions of how to evaluate risk for climate-smart technologies and digital solutions in emerging sectors. This financing gap delays growth, limits production capacity, and forces innovators to operate well below market demand.

(3) Commercialisation of services for users with limited ability to pay

Digital and green innovations face a disconnect between the end user and the paying customer. Many of the solutions studied create clear social or environmental value, but the commercial case is often less straightforward - especially in contexts where the primary beneficiaries have limited ability to pay. straightforward - especially in contexts where the primary beneficiaries have limited ability to pay. This plays out in several ways.

First, in cases where innovations resemble public service delivery-such as waste collection, sanitation, or rural energy access-it is not always clear who should cover the cost. A company like Fossetic, for example, offers septic tank maintenance that benefits households, but ultimately requires coordination with government actors to fund or mandate adoption.

Second, when users are expected to pay yet lack the ability to do so upfront, entrepreneurs face a liquidity gap. A solar irrigation provider may find that farmers can only pay after harvest, prompting a shift to pay-as-you-grow models-but this still leaves the business in need of capital to cover equipment costs in the interim.

Third, even when affordability is not the core issue, entrepreneurs often focus on building the product without fully understanding user priorities or commercial incentives. To illustrate, agri-data platform targeting farmers may find limited uptake, not because the tool lacks value, but because farmers face more immediate challenges-or because the real paying customers are upstream actors like food processors or offtakers who benefit from improved yields. Responding to these dynamics often requires entrepreneurs

to rethink their model entirely: who they serve, how they charge, and what kinds of partnerships are needed. But this type of business model innovation is not straightforward. It depends on early, sustained engagement with both end users and potential customers-something that does not always get the required attention.

(4) Fair competition

Some of the more advanced businesses face competition not from the private sector, but from public tenders and development partner-funded projects. For instance, solar energy businesses report that government contracts for large-scale off-grid electrification projects are often designed at a scale that, albeit unintentionally, exclude smaller (local) businesses because the procurement requirements are difficult to attain. Instead, these impactful projects are awarded to larger (foreign) companies that are able to meet the requirements. Additionally, these government contracts install systems at no cost to the end user, effectively distorting the market. A dynamic also seen in projects run by development partners, where development partners unintentionally replicate this pattern by funding free installation of technologies. The result is that once services are offered at no charge, local innovators seeking to build viable business models will have a hard time to find and convince users to pay for a similar service. Instead of providing opportunities for the private sector, it effectively establishes unfair competition with the use of public money.

	General challenges	Digital & Green-Specific challenges
Physical infrastructure	• Unreliable electricity supply, especially in rural areas • Poor road networks and transportation systems affecting logistics • Lack of reliable and affordable internet in many regions	• Inadequate digital infrastructure (e.g., poor internet, lack of rural connectivity) • Lack of suitable, rugged, and low-maintenance technologies for rural use • Weak logistics systems for deploying tech products
Finance	• Limited access to early-stage funding, especially seed capital • High collateral requirements for loans from banks • Lack of tailored financial products for start-ups and informal businesses • Investor risk aversion • Dependence on grants with slow disbursement • Fragmented grant funding landscape	• R&D financing is scarce-VCs and banks demand growth, not experimentation • Grants and development partner funds are short-term, restrictive, and distracting • Investors avoid ventures serving bottom-of-the-pyramid clients • Banks distrust 'unproven' technologies • Limited availability of scale-up finance (50k–500k range)
Policy	• Bureaucratic hurdles and slow government processes • Unclear or unsupportive regulations • Lack of formal legal recognition for social enterprises • Inconsistent policy enforcement • Ministries duplicating ESO services	• Legal frameworks don't accommodate emerging models (e.g., AI, platforms) • Government tenders often favor foreign firms, crowding out local businesses • Development partner/government programmes offering free solutions distort local markets • Lack of enforced policy to support digital/green transitions (e.g. lack of e-waste standards)
Knowledge	• Limited quality training beyond business basics • Language barriers restrict international engagement • Incubator offerings misaligned with real needs • Development partner KPIs undermine meaningful support	• Lack of technical coaching for product development • No access to domain-specific experts (e.g., agri, energy) • ESOs neglect technical R&D • End-users often lack digital and financial literacy • Entrepreneurs lack deep sector knowledge • Rare/fragile university partnerships
Culture	• Ecosystem actors operate in silos • Few visible role models • Entrepreneurs often chase grants through multiple incubators	• Development partner funding creates short-termism and stifles innovation • Risk aversion limits pivoting • KPI pressure values participation over real progress • Francophone entrepreneurs face extra barriers • Tech viewed with skepticism due to past failures
Market	• Fragmented markets and poor distribution • Lack of market data and customer feedback • No success stories or exits to build investor confidence	• Low purchasing power among key users (e.g., farmers) • Public-good nature of many solutions makes monetization difficult • Free government/development partner solutions distort willingness to pay • Need for B2B2C or off taker models • Poor visibility of solutions • Immature ecosystem delays uptake

Table 3: Overview of general and digital/green-specific barriers faced by entrepreneurs in Senegal, categorised by key elements of the entrepreneurial ecosystem.

4 Transition support: not yet driving the intended change

Despite growing investment in entrepreneurship support programmes across Senegal, many entrepreneurs and businesses interviewed in this study report that the system as it currently functions is not enabling them to grow their businesses effectively-let alone drive digital and green transitions at scale. Rather than addressing the real barriers faced by digital and green entrepreneurs-such as achieving product-market fit, engaging with customers, conducting R&D, and becoming loan-ready (section 3.2)-the ecosystem is shaped by development partner agendas, ESO performance metrics, and fragmented programming. This results in repeated, generic training offers, limited expert support, and a lack of long-term support. Five key challenges emerge from the fieldwork.

(1) Support comes with strings attached- and often distracts from business growth

Existing digital & green businesses who access support from development partner-funded programmes often do so through a combination of training and small grant schemes (often under $50.000). However, while most interviewed existing businesses agreed that entrepreneurship support programmes offer value-particularly in strengthening managerial skills, which several technically trained entrepreneurs found useful-they identified notable limitations. Access to funding is often conditional on the founder attending all training sessions-without the option to delegate to a colleague-regardless of the relevance of the content. The application process for these programmes is also resource-intensive and requires significant time away from day-to-day business operations. Several founders indicated that they consider these programmes as time-consuming, repetitive, and only partially aligned with their actual business needs, and therefore it is not worth the effort for the relatively small ticket size. Most training programmes focus predominantly on managerial skills, which benefit entrepreneurs with primarily technical backgrounds, but often fall short for existing businesses developing digital or green innovations. These businesses indicated they typically require more tailored support focused on refining their product-market fit, specific technological expertise, scaling strategies, strengthening supply chains, deepening customer understanding, and preparing for (debt) financing.

(2) Oversaturation of early-stage programmes undermines entrepreneurial learning and innovation

The entrepreneurial support landscape in Senegal is saturated with early-stage programmes, most of which are labelled as incubation. These programmes typically run from a few weeks to several months and offer a standard package of training on topics like human resources, marketing, financing, and pitching. They often come with mentoring and a small grant. On paper, these are meant for entrepreneurs with an MVP or early sales traction who are ready to formalise and grow their businesses. Inn reality, however, many of the participants remain in the pre-incubation phase: they are testing an idea, may not yet have a functioning prototype, and often have not acquired paying customers. This mismatch between the intended and actual

target group limits the relevance and impact of the support provided. Entrepreneurs at the pre-incubation stage often need different inputs-such as hands-on support to validate their idea, test with real customers, and understand their market-rather than abstract training modules on HR or investor readiness. But because ESOs are under pressure to meet development partner targets for the number of entrepreneurs trained, they are incentivised to fill programmes quickly, often accepting applicants who are not yet ready for incubation. There is also a practical constraint: the pipeline of businesses truly fit for incubation is limited, making it difficult to populate programmes with entrepreneurs that have the right profile.

At the same time, the oversaturation of incubation programmes has created a dynamic where entrepreneurs move from one incubation program to another with too little pressure to innovate or improve. Many entrepreneurs reported following three or more programmes, often with similar content. Taken into consideration that each program ends with some form of recognition or a grant, there is too little incentive to continue refining the idea and therefore a critical assessment of whether the business idea is sufficiently viable can be postponed. Few entrepreneurs reported having regular interactions with potential customers or making significant changes to their product or business model. Instead, most receive repeated validation from trainers and mentors, reinforcing the idea that their concept is already on the right track. The result is a cycle where early-stage ideas are recycled through the ecosystem without being seriously challenged or improved. Rather than focusing on building a product that paying customers want, entrepreneurs focus on meeting program requirements and securing small grants. In the absence of competitive pressure or structured feedback from the market, innovation stalls. The support system rewards participation more than progress, and entrepreneurs are rarely pushed to let go of a weak idea and develop a better one.

(3) Structural gaps in post-incubation support leave growth-stage businesses behind

While early-stage support is abundant, entrepreneurs entering the acceleration phase-i.e. those with a registered business and growing sales-face a much more fragmented and underdeveloped support landscape. There are very few structured, high-quality acceleration programmes. Most support in this phase continues to come from development partner-backed initiatives, each with their own application process and reporting requirements. This forces entrepreneurs to spend significant time patching together resources from multiple sources, diverting attention away from running the business. Several of the businesses interviewed reported receiving technical assistance alongside financing (usually between $50.000-$300.000), but described this support as generic, short-term, and more of an afterthought than a core offering. In many cases, the content is similar to incubation training and fails to address the specific challenges of scaling a digital or green business, such as deep expert knowledge to refine product offering, strengthening supply chains, expanding customer acquisition strategies, or navigating regulatory issues. Private investment (from business angels or venture capital) remains limited in Senegal, especially in the $50k–$500k bracket that typically defines the acceleration phase. As a result, development partner programmes are often the only source of significant growth-stage capital-while these tend to support the usual-suspects of promising businesses. While these businesses are undoubtedly strong candidates.

they are still in the process of scaling and have not yet reached their full potential. Treating them as "national champions" may obscure the need for continued, targeted support. Moreover, repeated exposure to grants rather than revenue-based models may unintentionally reduce the pressure on such businesses to become financially self-sustaining.

(4) Fragmented government involvement adds complexity

In recent years, several government ministries have started to launch their own programmes targeting entrepreneurs, including incubation initiatives. However, these efforts are often implemented in-house and lack coordination with existing ecosystem actors such as ESOs or the national agency for entrepreneurship development, Délégation générale à l'Entrepreneuriat Rapide des Femmes et des Jeunes (DER/FJ). This results in duplication of efforts, competition for ESOs, and dilution of overall support quality, as ministries tend to deliver entrepreneurship training without the necessary expertise or experience, since it is not their core mandate. Rather than strengthening the ecosystem, this continuation of unaligned programmes risks confusing entrepreneurs and spreading resources too thinly across parallel initiatives.

(5) The development partner–ESO system prioritises scale over substance

Finally, a core structural issue lies in the way development partner–ESO partnerships are structured and managed. Program goals and key performance indicators are typically defined in advance by development partners, leaving ESOs with little flexibility to adapt content or delivery based on on-the-ground realities. While many development partners conduct feasibility studies at the design stage, multiple stakeholders report that these insights rarely translate into meaningful adjustments to the terms of reference.

As a result, most ESOs focus on delivering what the contract requires: time-bound training with pre-selected topics, focused on reaching a set number of participants. Long-term technical assistance, expert mentoring, or in-depth follow-up are rarely included in program design-and therefore not delivered. Yet these are precisely the forms of support that entrepreneurs themselves say they need most. Supporting a small number of businesses over a longer time frame, with tailored inputs and access to sector-specific expertise, may generate far greater impact in terms of job creation and innovation. However, such models are harder to justify under public-sector accountability frameworks that favour visible, short-term outputs (e.g. "we trained 200 entrepreneurs" is better than supporting only 10 businesses for 5 years even though these 10 businesses might have created much more jobs) over long-term outcomes.

At the same time, ESOs themselves are not merely passive implementers but active actors whose choices shape ecosystem outcomes. Many ESOs adopt a "tell us what you want and we will deliver" mentality, rarely pushing back on development partner priorities or questioning whether KPIs and program designs truly fit local needs. This passivity reflects, in part, the fact that many ESOs are young organisations—often resembling start-ups themselves—still experimenting with their own business models. For some, entrepreneurship support has become more of a funding opportunity than a mission-driven endeavour, limiting their willingness to invest in quality standards, pricing models, or long-term impact. Others lack the

skills, experience, or vision to position themselves as leaders capable of shaping development partner agendas rather than simply following them. ESOs hold significant responsibility for raising the level of professionalism and agency in the ecosystem, yet too often default to meeting foreign-designed KPIs instead of setting their own standards of quality and impact.

5 Conclusions and recommendations

This white paper examines how digital and green transitions are emerging in Senegal, focusing on agriculture, waste management, and small-scale renewable energy. It is the first in a three-part series exploring how these so-called "twin transitions" unfold in African countries with active entrepreneurship ecosystems but limited systemic change. The goal is to understand why early-stage innovation is growing, yet sector-wide transformation remains elusive. The Multi-Level Perspective (MLP) provides a structured way to understand how sustainability transitions fuelled by digital unfold over time.

Using the MLP, we find that digital and green transitions in Senegal are largely confined to the niche level, with strong activity in the predevelopment phase, and activity in the take-off phase-but not yet a lot of progress beyond it. While we identified eight innovations in take-off, these have yet to reach the acceleration phase, where broader adoption disrupts existing systems. Solar irrigation is a borderline case, but is still faced with structural and systemic barriers. The entrepreneurial ecosystem has played a key role in nurturing niche activity. It has been effective in enabling early-stage experimentation: protecting ideas from market pressure, providing grants and training, and fuelling a highly visible wave of innovation. However, when it comes to supporting businesses to move from early experimentation into real growth and adoption (predevelopment to take-off, or take-off to acceleration), the system falls short. And this matters - while supporting entrepreneurs grow into successful businesses is a core goal of the EE the ecosystem is currently insufficiently equipped to meet this goal.

As discussed in Section 4.2, the structure of entrepreneurship support in Senegal might be currently unable to adequately meet the actual needs of digital and green innovators. Many programmes offer generic, one-size-fits-all content, focused on basic managerial skills like business planning or pitching. While this may benefit some entrepreneurs, it does little for entrepreneurs trying to refine a product, understand a complex market, or prepare for (debt) financing. A key reason is that most programmes are designed around development partner KPIs, which reward quantity-how many entrepreneurs were trained-over quality-business impact and growth. This creates pressure to fill programmes quickly, even when the applicant pool of aspiring entrepreneurs doesn't match the intended target group of existing early-stage businesses. At the same time, growth-stage support is scarce, and technical expertise is difficult to find. Most ESOs do not provide access to the kind of deep, sector-specific knowledge that digital and green businesses need-whether in agronomy, engineering, or energy systems. On the finance side, available funding remains small, fragmented, and poorly aligned with the capital needs of businesses. Grants are often tied to training participation, and few businesses access (both debt and equity) financing in the $50k–$500k range where real scaling happens. As a result, many entrepreneurs become stuck in a loop-cycling through similar programmes, collecting small grants, but never receiving the targeted support, capital, or technical input needed to grow beyond early-stage experimentation. That said, the entrepreneurial ecosystem cannot drive transitions alone. According to the MLP, landscape pressures and regime dynamics are equally important,

ee **Figure 2** for an overview. In Senegal, landscape alignment is mixed. On the one hand, there is strong policy-level attention to innovation, entrepreneurship, digitalisation, and sustainability. On the other, this general policy support does not translate into targeted, sector-level action that could help promising innovations to challenge current regime structures. There are few incentives that support specific innovations to scale, and even fewer disincentives to phase out unsustainable regime practices. For example, agricultural fuel subsidies directly undermine the economic case for solar irrigation, while public procurement processes rarely prioritise local, sustainable innovations. Without focused regulatory and fiscal tools-such as green procurement rules, targeted subsidies, or carbon pricing-new solutions remain stuck in weak market positions, unable to scale. Additionally, consumer demand for green solutions is weak, especially when these require high upfront investment. People adopt green innovations when they are cheaper, better, or clearly solve a local problem-not because they align with abstract climate goals. The cultural and economic context understandably and justifiably prioritises affordability and practicality over environmental value. Thus, as mentioned by an Senegalese investor, innovations need to provide "African solutions, for real African problems".

Development partners, too, exert landscape pressure by shaping funding flows and dominant narratives. Their focus on green and digital has been instrumental in seeding and shielding early innovation-mainly through grants, pilot funding, and thematic programmes. This influence has proven effective in stimulating predevelopment, but is largely absent during the critical phases of take-off and acceleration. What's missing is sustained, strategic support for businesses that are already gaining traction-particularly in the form of growth-oriented finance (including debt), longer-term technical accompaniment, and hands-on support to refine customer fit. Equally importantly, support is needed that fosters collective momentum among businesses working on similar solutions-supporting them not only to scale individually, but also to reinforce each other's presence in the market, challenge dominant practices, and shift sectoral norms. These types of interventions fall outside the scope of most development partner-funded programmes, which tend to be short-term, grant-based, and focused on training early-stage entrepreneurs rather than enabling systemic change.

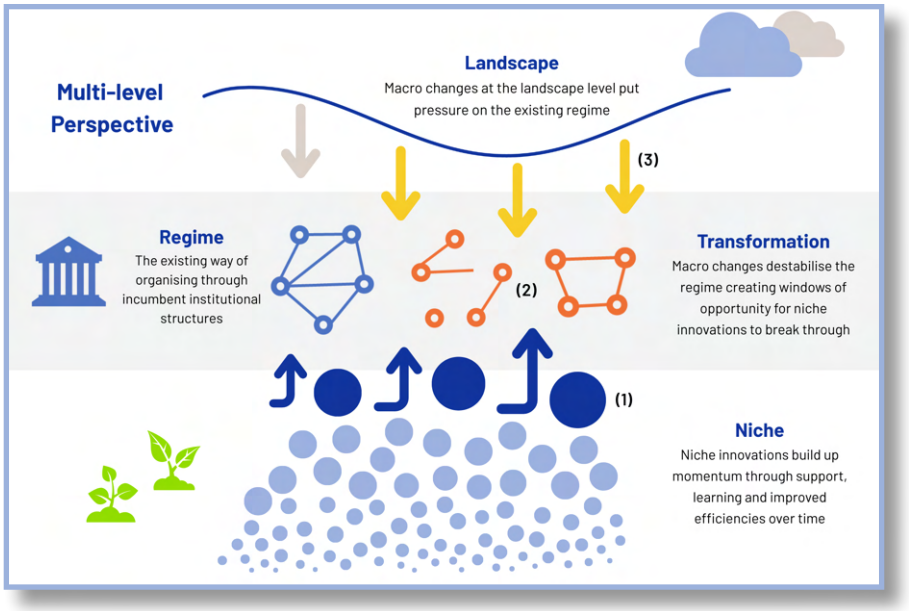

*Figure 17: Current support from the entrepreneurial ecosystem focusses on incubation, acceleration and investment in the niche level, but neglecting the importance of innovations to converge to a dominant design and challenge the business as usual (blue dynamic, labelled **(1)**). Landscape pressures mainly focus on general innovation, digitalisation and sustainability policy, without targeted policy to stimulate specific innovations and disincentivise unsustainable regime practices (red dynamic, labelled **(2)**), leading to insufficient pressure from both the niche and landscape to destabilise the business as usual, and allow for the new innovation to replace the business as usual (orange dynamic, labelled **(3)**).*

In short, the twin transition in Senegal is underway-but uneven. There is significant activity in the predevelopment phase, driven by an advanced, development partner- and publicly-funded entrepreneurial ecosystem that excels at stimulating early-stage innovation and experimentation. However, few innovations have reached take-off, and none have yet entered acceleration. Niche activity is high, but breakthroughs are rare. If the entrepreneurial ecosystem is to contribute meaningfully to systemic transition, it must evolve-from enabling experimentation to enabling real growth. This means moving beyond generic support models and working in concert with policy, finance, and market systems to create the structural conditions necessary for innovation to scale and regimes to shift.

In parallel, more attention must be paid to actively dismantling existing unsustainable regime practices. Transitions do not occur through innovation alone-they require pressure on the status quo. This is where the role of government becomes critical: not just through high-level strategies, but through targeted, sector-specific policies that help promising innovations grow. That includes removing harmful incentives, aligning procurement and regulation with green and digital solutions, and designing instruments that reward adoption of sustainable alternatives. Without these targeted interventions, innovations remain stuck at the margins-and the dominant practices they aim to replace continue to dominate.

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For questions you can contact:

d4d@rvo.nl