

ClimateTech Horizons

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The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing MNOs and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

We invite you to find out more at gsma.com

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GSMA ClimateTech

The GSMA ClimateTech programme unlocks the power of digital technology in low- and middle-income countries to enable their transition towards a lowcarbon and climate resilient future. We do this with the collective support of the mobile industry, as well as public and private actors. Through our research and in-market expertise, we catalyse strong partnerships, facilitating innovative digital solutions that address key challenges. Our work spans climate mitigation, adaptation and resilience strategies across the globe.

For more information about the ClimateTech programme, visit <u>gsma.com/climatetech</u>

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GSMA



Chief Regulatory Officer, GSMA and President of the GSMA Foundation, GSMA

As the impacts of climate change are increasingly felt around the world, the need for urgent and innovative action by governments, industries and communities has never been more important.

We are at a critical juncture, and mobile technology stands as a powerful tool for sustainable development. The mobile industry today serves more than 5.6 billion people, with networks now covering 96% of the world's population.¹ With this great reach comes great responsibility. Our *ClimateTech Horizons* report reflects our commitment to harnessing the sector's resources and expertise for the benefit of our planet and its people.

Innovation is at the heart of our efforts. From apps reducing knowledge gaps for farmers to precision agriculture powered by AI, this report is filled with examples of how mobile connectivity is empowering action. This action helps communities become more resilient to the impacts of climate change and build successful businesses that strengthen their economic resources.

Collaboration is vital to our mission. Climate change is a complex, multifaceted challenge that requires a unified approach. This report shows how the GSMA Mobile for Development (M4D) team works in partnership with governments, NGOs and industry leaders to drive collective action. These alliances enable us to scale up successful initiatives and ensure the benefits of mobile and digital technology reach the most vulnerable populations.

While we celebrate the achievements to date, we also recognise the challenges ahead. Bridging the digital divide, particularly in remote and underserved areas, remains a critical task. We must work to ensure that everyone, regardless of

GSMA. (2024). <u>The Mobile Economy 2024.</u> GSMA. (2024). The S<u>tate of Mobile Internet Connectivity Report 2024.</u>

their location or socio-economic status, has access to the technologies that can help them mitigate and adapt to climate impacts. Governments have a critical role to play in ensuring supportive policy frameworks that foster the integration of mobile solutions into national and global climate strategies.

It is my sincere hope that this report provides you with both inspiration and a renewed sense of urgency. The examples of innovation we present demonstrate what's possible when we unite and harness the power of mobile technology to combat climate change. Together we can drive progress, foster collaboration and create a more sustainable future for all.



Introduction from Akanksha Sharma

Head of ClimateTech and Digital Utilities, Mobile for Development, GSMA

For more than a decade, the GSMA Mobile for Development programme has partnered with donors to drive low-carbon, climateresilient solutions through mobile and digital technologies. We see tech as a vital ally in empowering communities in low- and middleincome countries (LMICs), where climate impacts hit the hardest. The inaugural Digitalisation Day at COP29 was a landmark moment, underscoring global recognition of technology's immense potential to drive meaningful climate action.

As digital solutions evolve and mobile connectivity expands, our focus is on channelling these advancements into cutting-edge approaches to reduce emissions, enhance adaptive capacities and build lasting climate resilience. The real impact comes when these innovations are grounded in local needs, co-created with communities and scaled sustainably.

Throughout our M4D programmes, we've seen what's possible - from startups using technology to build community resilience across Africa and Asia, to pioneering climate initiatives led by the mobile industry. This report distils the lessons we've learned over the past year, with the hope of sparking fresh ideas and the next wave of impact.







Contents

1. Introduction	4
Foreword	4
Introducing ClimateTech Horizons	5
2. GSMA Mobile for Development (M4D)	8
Our climate impact	8
How M4D is tackling climate challenges	9
3. The mobile industry and climate action	12
Mobile-enabled early warning systems	15
SPOTLIGHT How and why mobile operators are looking to renewables to power networks across Africa	16
4. Innovation funding	18
Driving climate action through GSMA grants: Meet the grantees	18
Trends in climate tech innovation pitches	22
SPOTLIGHT How do you measure the impact of climate tech?	25
5. Agritech	26
What have we learned from our agritech startups? Trends and case studies	28
Investment readiness: A toolkit for agritech innovators	32
SPOTLIGHT Exploring EUDR: A boon for agritech innovation, but will it leave smallholders behind?	36

6. Circularity

Innovations and startups disrupting circu
Circularity and the mobile industry
SPOTLIGHT Safaricom and Taka Taka Ni M management in Kenya
Nature
Exploring biodiversity business models
Lessons from our traceability startups
SPOTLIGHT How is the mobile industry ta
Blue economy
Driving blue innovation through GSMA g
Case study: Deploying Internet of Things
SPOTLIGHT Explore our Blue Tech Heatm
AI for climate action
The transformative potential of AI in Afric
Lessons from our AI-backed startups
SPOTLIGHT Driving climate action with A What role can the mobile industry play?
0. Climate finance
Unlocking climate finance through innova
The rise of digital monitoring, reporting a
SPOTLIGHT I Navigating the voluntary cark





	38
larity	40
	43
lali: Piloting smart waste	47
	48
	50
	52
ckling biodiversity loss?	54
	56
rants and partnerships	58
fishing lights in Lake Victoria	62
ар	63
	64
ca	66
	68
I innovations in Asia Pacific:	71
	74
ative mechanisms	76
and verification	79
oon market:	80



ClimateTech Horizons

The opportunity

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Digital solutions are uniquely positioned to drive climate action by:

 Mitigating the primary driver of climate change by reducing greenhouse gas emissions

- Building resilience to the impacts of climate change for the most vulnerable communities Driving sustainable use, management and protection of natural resources and the environment in areas exposed to climate stressors



We catalyse partnerships between government, mobile operators, innovators and service providers



We fund and support innovative solutions to climate problems







Funding

Partners

to unlock longer-term impact through:

- Increasing access to services
- Capacity building and training
- Sharing insights and evidence
- Strategic advisory support
- Technical assistance



Climate action

For the GSMA, climate action^{2,3} means activities that:



reduce greenhouse gas emissions and **mitigate** climate change







drive sustainable use, management and protection of natural resources and the environment in areas most vulnerable and exposed to climate change stressors

ClimateTech green glossary

More and more, environmental challenges are being addressed with mobile and digital solutions. To navigate innovative approaches to climate action, an understanding of key terms is essential.

Our <u>ClimateTech Green Glossary</u> clarifies these terms, defining key concepts at the intersection of climate action and technology.

Climate resilience

Climate resilience⁴ means supporting communities and vulnerable groups to:



ANTICIPATE

climate variability and risks from extreme climate events, supporting preparedness and planning (e.g. through early warning systems)



ADAPT

to multiple, long-term and evolving climate change risks (e.g. through precision agriculture and long-term weather forecasting)

adverse conditions, emergencies or disasters (e.g. through access to credit and insurance in the event of a climate disaster)

ABSORB

2. UNDP. (2022). Climate Action from the Ground Up: Supporting Cities and Local and Regional Governments to Achieve the Paris Agreement.

3. United Nations Sustainable Development Goals. (2022). "Climate Action".

4. ODI Global. (2015). The 3As: Tracking Resilience Across BRACED.







Our green glossary is designed to foster a shared understanding and empower our partners for climate action

The mobile industry was among the first in the world to commit to achieving net-zero carbon emissions

3. The mobile industry and climate action

We know that the mobile industry has transformative potential to drive climate action. By expanding access to digital services, the sector connects underserved populations, fosters economic growth and promotes digital inclusion - key building blocks for resilience to climate shocks and stressors.

Beyond the industry's own commitments, mobile network operators (MNOs) are at the forefront of building climate resilience in LMICs, leveraging digital connectivity to empower communities on the front lines of climate change.⁵ With extreme weather events happening more frequently, countries need to communicate urgent information to citizens to help them get to safety. The GSMA supports the global Early Warnings for All Initiative, which aims to cover the world population by the end of 2027. By providing real-time data for early warning systems and critical weather information, mobile networks help to save lives and safeguard livelihoods in the face of natural hazards.

The race to net zero

The mobile industry was among the first in the world to commit to achieving net-zero emissions, setting a benchmark for other industries to follow and positioning itself at the forefront of climate action.^{6,7} To support net zero, the GSMA created the Climate Action Taskforce, which now has 77 members, covering 80% of global connections and 150 countries.



MNOs

representing nearly half of global mobile connections have committed to near-term, science-based targets aligned to net zero by 2050.8



The industry has made **notable** progress, with many MNOs working towards halving emissions by 2030 through energy efficiency, renewables and supply chain engagement.

oment Report 2023, the United Nations has proposed a framework built around six ese six investment pathways, with the UN highlighting the vital role of conv avations can be built for the benefit of all society.

. In 2019, the mobile industry set an ambitious target to reach net zero by 2050, recognising its potential to drive significant environmental change through digital technologies and connectivity.

ivitv is one of these six inv

^{6.} GSMA. (2024). Mobile Net Zero 2024: State of the Industry on Climate Action.

^{8.} GSMA. (2024). Mobile Net Zero 2024: State of the Industry on Climate Action.

Mobile technology can also **drive innovative** solutions across other industries, facilitating climate-smart agriculture and more efficient management of natural resources, enabling communities to adapt to changing conditions. With mobile money services offering secure, direct access to funds, the industry is transforming how vulnerable populations withstand and respond to climate challenges through better access to finance. Through this 'enablement effect', MNOs can act as catalysts for the decarbonisation of other sectors and support greater climate resilience in the communities where they operate.

Another key role of the mobile industry is in collaboration and partnerships that bring together diverse climate stakeholders - from governments and academics to tech innovators and local communities. By working closely with partners, the mobile industry can accelerate the deployment of climate-smart technologies and help innovative solutions to scale. Examples of partnerships in this report illustrate how support from the mobile industry can drive meaningful progress in climate action.

Climate priorities for mobile network operators in 2025

The GSMA ClimateTech programme spoke with leading MNOs across LMICs to uncover the key priorities, drivers and challenges for sustainability teams. In these regions, MNOs face distinct hurdles: navigating complex regulations, balancing climate commitments with connectivity expansion and working with limited renewable energy resources.

In 2025, energy efficiency, emissions reduction and circularity are set to be top priorities for MNOs across Africa, Asia and the Middle East and North Africa (MENA), driven by both regulatory requirements and corporate ambitions. Despite ambitious internal goals, MNOs are feeling the strain of reporting obligations within tight budgets. Their ability to innovate under these pressures will be essential to achieving sustainable growth and climate resilience across LMICs.



Mobile-enabled early warning systems

The GSMA and the Early Warnings for All Initiative

In the past 20 years, natural hazards have claimed the lives of more than 1 million people, with 90% of these deaths occurring in low- and middle-income countries. The rising frequency and severity of these disasters are linked to the climate crisis, with predictions that climate change could drive as many as 130 million people into extreme poverty by 2030.9

With the growing frequency and severity of disasters, early warning systems (EWS) and effective risk communication are becoming ever more essential. These systems provide a proactive strategy for disaster risk reduction, enabling timely actions that can greatly reduce both loss of life and economic impacts.

In 2022, the Early Warnings for All (EW4All) Initiative By harnessing the power of mobile technology, the was launched with the aim of ensuring that everyone industry is ensuring that vulnerable communities in the world is protected by an EWS by 2027. While are better prepared and protected, delivering lifethe EW4All Initiative has brought new attention to saving EWS to those who need them most. the importance of EWS. MNOs have been enabling the development and implementation of EWS Learn more about the GSMA's role in the Early for decades. Cell broadcast, location-based SMS Warnings for All Initiative here. and digital technologies are uniquely positioned to provide targeted and accessible information to Learn about the GSMA Innovation Fund grantees communities. advancing EWS here.



^{9.} Jafino, B.A. (2020). "Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030". Policy Research Working Paper 9417. World Bank Group





The GSMA Mobile for Humanitarian Innovation (M4H) programme has been driving the role of the mobile industry in EWS for several years. It is actively contributing to the EW4All Initiative by convening the mobile industry, fostering multisectoral partnerships, investing in EWS through the GSMA Innovation Fund, publishing insights on mobile-enabled EWS and providing technical assistance to MNOs and partners.



At COP29 in Baku, Azerbaijan, the GSMA took part in discussions on scaling up climate finance to support ambitious action on EWS for adaptation, particularly for the most vulnerable. The event was organised by the International Telecommunication Union (ITU).

Spotlight How and why MNOs are looking to renewables to power networks across Africa

is a crucial challenge for MNOs. Over the past year, several MNOs submitted new near-term targets to the Science Based Targets Initiative (SBTi), bringing the total to 75 MNOs representing nearly half of global mobile connections.¹⁰

To achieve these targets, MNOs must accelerate their transition to renewable energy. This is especially important in African countries, where a significant proportion of mobile tower infrastructure is in off-grid and bad-grid areas and the industry cannot rely on national grids to go green. Many MNOs and tower companies have made significant progress, showcasing scalable and sustainable solutions. With Africa's unique energy contexts, regulatory landscapes and geographies, there is no one-size-fits-all answer. However, two approaches have had a big impact in off-grid and bad-grid areas.

Reducing CO2 emissions across the mobile industry **1. Energy Service Company (ESCO) model**

While MNOs and tower companies are strengthening their in-house expertise and capabilities on energy, managing the supply of reliable power is not a traditional core business competency.¹¹ Managing power at tower sites carries risks, from power generation and delivery to financing. By outsourcing responsibility for power generation and delivery, tower operators can offload some of the challenges associated with mobile towers in off-grid or bad-grid areas to the energy service company (ESCO). The chart below shows the growth of the ESCO market in Africa and the Middle East.

Historically, ESCOs have managed diesel fuel supply and generator operations for MNOs. Recently though, they have shifted to providing renewable energy installations for tower sites. Their business models favour renewable energy investments due to long-



term contracts with MNOs and tower companies. Typically lasting 10 years or more, these contracts allow for extended depreciation of equipment and attractive financial returns. Several ESCO initiatives focussed on renewable energy have emerged across Africa.

For example, Airtel Nigeria has partnered with Watt <u>Renewable Corporation</u>, an independently owned provider of hybrid solar solutions, to deliver more than 32 MW of installed capacity of solar photovoltaics (PV) and storage across 600 sites under an energy-asa-service power purchasing agreement.¹²

2. Anchor-Business-Community (ABC) mini-grid model

In off-grid locations, there is an opportunity to design, install and operate mini-grid systems that use renewable energy to supply electricity to mobile towers. MNOs and tower companies are the anchor clients, but these systems can also serve local businesses and households. For mini-grid providers, having a mobile tower as an anchor client ensures constant energy demand, helping to balance energy loads and increase commercial viability.

While the ABC model has been around for more than a decade,¹³ it has encountered several challenges: implementation, scale, financing and lack of stakeholder alignment. As Africa's mini-grid sector has matured, with companies scaling up and securing significant financing, solutions based on an ABC model have also expanded.

In Bukavu, a city in the Democratic Republic of Congo (DRC) that faces frequent grid outages, **Orange** partnered with **Bboxx**, a pan-African off-grid solar provider, and **GoShop**, the largest solar engineering, procurement and construction company in the country. The joint venture built a hybrid mini-grid plant to supply energy to Orange's

10. GSMA. (2024). Mobile Net Zero 2024: State of the Industry on Climate Action.

11. ITWeb. (13 November 2017). "Why ESCOs are the future for African telecom tower power"

12. O'Grady, V. (12 September 2023). "Airtel Nigeria boosts solar PV capacity with help from Watt". Developing Telecoms.

13. GSMA. (2013). Safaricom - Kenya - Feasibility Study.

14. Orange. (18 June 2024). "Orange Energies opens up its digital platform, Orange Smart Energies, to enable all energy producers to secure their revenues and further support energy inclusion". Press release.

16. GSMA. (2020). Électricité de Madagascar - Enabling Access to Electricity through Mobile-enabled Rural Mini-Grids

17. GSMA. (2023). The Mobile Economy Sub-Saharan Africa 2023.





telecoms infrastructure. 85% of the energy will be generated through solar panels, connecting more than 600 households around the telecom tower to clean energy solutions and services. The partnership also allows Bboxx to partner with Orange Energies to integrate their smart metering platform with Bboxx Pulse,[®] a proprietary, fully integrated operating system.¹⁴ The merger of these technologies will enable both close monitoring of the mini-grid's performance and remote customer management, including the collection and management of payments through pay-as-you-go (PAYG) solutions. Bboxx and Orange hope to replicate this model in other tower sites and scale it across the DRC.¹⁵

WeLight, a joint venture of Axian Group, Sagemcom and Norfund, operates mini-grids in Madagascar and Mali, and has pioneered several ABC model projects. In 2018, the GSMA Innovation Fund provided a grant to test the commercial viability of providing electricity to off-grid villages in northern Madagascar while leveraging Telma Madagascar's off-grid mobile towers as anchor clients.¹⁶ Once they had proved the model was viable, WeLight scaled up and now powers 31 offgrid mobile tower sites in the country, partnering with Helios Towers and Towers of Africa.

Looking ahead

As demand for digital services and digital connectivity increases across Africa,¹⁷ scalable, sustainable, reliable and affordable energy solutions for MNOs and tower companies will be critical. While it is encouraging that many MNOs have begun greening their networks, accelerating the shift to renewable energy is essential for both MNOs and tower companies to ensure long-term commercial success and fulfil their environmental, social and governance commitments.

Read the full blog to learn more about how MNOs in Africa are greening their network infrastructure.

15. Bboxx. (1 July 2022). "Bboxx partners with major telecommunications operator Orange to connect 150,000 people in DRC to an innovative mini-grid model".

4. Innovation funding

Driving climate action through GSMA grants

With mounting climate challenges, the demand for innovative solutions has never been greater. Yet, a critical funding gap remains, especially for early-stage startups. Supporting local, homegrown solutions is key to empowering innovators to make meaningful change.

Since 2021, GSMA Mobile for Development, funded by UK International Development from the UK Government and the Swedish International Development Cooperation Agency (Sida), has been providing grants to startups across Africa and Asia through the <u>GSMA Innovation Fund for Climate</u> <u>Resilience and Adaptation</u>. The objective is to accelerate the testing, adoption and scalability of digital innovations that enable the world's most vulnerable populations to adapt to, anticipate and absorb the negative impacts of climate change.

The first round, launched in 2021 with 12 grantees, concluded in 2024. Building on this success, the second cohort was announced in 2024, with 11 more startups selected from nearly 600 applicants. Their focus: underexplored sectors and breakthrough solutions. By offering equityfree grants (£100,000-£250,000) and tailored support, the Innovation Fund derisks investment, driving innovation and attracting private-sector engagement in climate adaptation.

GSMA

Supporting local, homegrown innovations is key to meaningful climate action



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Trends in Innovation Fund pitches

Our second call for the GSMA Innovation Fund for Climate Resilience and Adaptation drew nearly 600 pitches from global innovators, offering a unique snapshot of key trends in technology for climate action. We assessed each pitch for its potential to have a positive impact on vulnerable communities, generate sustainable revenue, scale effectively and leverage partnerships with the mobile industry. Here's what we learned from the latest round of applications:

1. Smallholder farmers were the main target users

As we saw in the first funding round, agricultural solutions dominated the applications, with 60% of projects focussing on this sector, particularly in North, East and West Africa, and South Asia. Consequently, smallholder farmers in rural areas were the most common target user group across the projects submitted. This indicates that startups are aware of both tried-andtested initiatives and new business opportunities in this sector, and that there is a gap or need for more investment and opportunities in other sectors.

2. High representation of local innovators, particularly in Africa

We encouraged submissions from local entrepreneurs and homegrown talent and found that **90% of solutions were designed and delivered locally**. This shift is significant, as locally led adaptation is essential for building longterm, sustainable climate resilience.

71% of applications were from Africa, 25% from Asia and less than 4% from Latin America and the Caribbean and the Pacific.

Of the international solutions pitched, 72% were from companies

The GSMA Innovation Fund for Climate Resilience and Adaptation 2.0





Other regions 0.4%



Many pitches featured tech 'buzzwords' - Al, blockchain and IoT - without clearly explaining their application or development. For example, although 40% of applicants claimed to use blockchain in their solutions, our analysis found that only 12% had integrated it as a core component of their projects. This suggests a gap between the ambition to use cutting-edge technologies and the reality of implementing it. Or, perhaps there is an expectation that in an Al-first world, only cutting-edge technologies receive funding.





headquartered in high-income countries, while 28% were proposed by companies from LMICs intending to implement their solution in a neighbouring country. This suggests a scarcity of transnational climate tech start-ups in LMICs, with many possibly still focussed on their domestic markets and yet to expand internationally.

3. Startups are combining multiple innovative technologies

Most startups proposed solutions that combine multiple technologies. Nearly three-quarters (73%) of the pitches involved a mobile app, reflecting the widespread use, accessibility, convenience, monetisation opportunities and rapid development of mobile apps.

At a regional level, more startups in Africa pitched solutions using mobile money (59%) than startups in Asia (30%), while 39% of startups in Asia proposed using AI compared to 26% in Africa – a reflection of different regional advancements and market demand for these technologies. These patterns reflect trends from the first funding round, highlighting persistent disparities in technological adoption and the diverse priorities of startups across regions.

4. More female entrepreneurs and solutions targeting women

Of all the startups that applied to the Fund, 56% had at least one female member on their executive board or were female-founded, compared with less than half from the previous round of applications. This is a positive trend, as women and girls are disproportionately impacted by climate change, and it is critical to have female leaders and thinkers designing targeted solutions that address the needs and build the resilience of women and girls.

A third (33%) of the startups designed either their entire mobile and digital solution or a component of it to specifically target women in

49%



Startups were asked to explain how their solution would benefit potential partnerships with MNOs.

communities vulnerable to the impacts of climate change. Less than half (42%) of startups targeted women and men equally, while just 13% did not focus on women in their solution. In the new GSMA Innovation Fund cohort, a third of the startups are female-founded.

5. Challenges in articulating pathways to scale

Effectively conveying business plans that are both sustainable and scalable is often a major hurdle for startups. Most applicants were able to explain a high-level business approach and target customer base, with 73% of pitches using a business-to-consumer (B2C) model and 61% a business-to-business (B2B) approach. However, many struggled to expand on their business model beyond identifying their customer base, or to give a clear explanation of how they plan to scale up their solutions in the long term. They also struggled to articulate the value proposition of their mobile and digital solution for MNOs to leverage a partnership (see the figure above).

Applicants that provided clear responses to questions about their pathway to sustainability referenced expanding their user base in their domestic and/or regional market, adding to their product and service offerings or selling carbon credits to generate additional revenue. Many earlier stage startups also listed continued grant funding as a pathway to sustainability, highlighting the different interpretations of the question. By collaborating with the selected innovators, the GSMA aims to bridge the gaps identified by these trends – not only by providing equity-free grants but also through bespoke technical assistance to address their specific needs. Leveraging the unique position of the GSMA within the broader mobile ecosystem, the Innovation Fund enables selected organisations to partner with a wide network of investors, MNOs and technical partners to support their journey to scale.

What's next?

In 2024, we completed our first funding round with 12 pioneering startups whose experiences are featured in the following chapters. In 2025, we will shift to supporting the second cohort of the Innovation Fund by building partnerships, tailoring our technical assistance and raising their profile among investors. By supporting these digital innovations, use cases and business models, we aim to generate insights and advance sustainable, scalable and underexplored solutions for climate resilience and adaptation.

Spotlight

How can startups measure the impact of climate tech?

For many startups, assessing and measuring the impact of their solutions can be a daunting task. While applicants to the GSMA Innovation Fund for Climate Resilience and Adaptation were required to outline their evaluation strategies, few had directly integrated data collection mechanisms in their solutions, such as feedback logs within mobile apps.

This lack of built-in monitoring tools makes it difficult for startups to track and demonstrate the real-world impact of their innovations. Also, many proposals to measure environmental or biodiversity impacts were either too broad to capture meaningful results or too resource intensive, making them impractical for earlystage startups with limited resources. This highlights a significant gap in technical skills for effective monitoring and evaluation, which are essential not only for showcasing impact, but also for attracting additional investment and funding.

Recognising these challenges, the GSMA is working to support grantees in piloting new methodologies for impact assessments. These efforts include conducting environmental impact assessments and using geospatial analyses to evaluate the effectiveness of the innovations supported by the Innovation Fund. By helping startups develop robust measurement and evaluation frameworks, the GSMA is enabling them to integrate these systems in their solutions from the outset, rather than relying on separate and resource-intensive processes. This support is crucial for building evidence on the efficacy of mobile and digital solutions, and empowering startups to secure the resources they need to scale their innovations and have a greater impact.

Learn more about climate tech evaluation methodologies in our blog, "<u>Five steps to</u> <u>measuring environmental impact of climate</u> <u>tech innovation</u>".







More than of the world's food is produced by smallholder farmers

5. Agritech

Supporting agritechs across Africa and Asia

Smallholder farmers are vital to feeding the world, yet they are increasingly vulnerable to the impacts of climate change. As food demand rises globally, new technologies are transforming traditional farming methods, helping farmers in LMICs to adapt and thrive, even in the most remote areas.

Agricultural solutions took centre stage in the first round of the GSMA Innovation Fund for Climate Resilience and Adaptation, making up 46% of all applications.²¹ In the second round, this focus intensified, with 60% of applicants serving the agriculture sector.²²

The solutions pitched ranged from climatesmart agricultural services²³ that aimed to make crop production more efficient, to weather forecasting, credit and insurance to help mitigate the risks of climate shocks and stressors. The prominence of agritech solutions highlights a growing recognition of the close links between agriculture and climate change, as well as a strong appetite for investment in the sector. Recent GSMA analysis found that only 2% of global venture capital investments go to agritechs in LMICs. The Innovation Fund seeks to reverse this trend by de-risking innovation and providing financial backing to the sector that traditional venture capital often hesitates to offer.

- 19. The Mastercard Foundation Rural and Agricultural Finance Learning Lab and ISF Advisors. (2019). Pathways to Prosperity: 2019 Rural and Agricultural Finance State of the Sector Report. 20. World Bank. (2018). Ending Poverty and Hunger by 2030: An Agenda for the Global Food System. Second edition.
- 21. Hafiz, S. and Colquhoun, A. (8 November 2022). "<u>Application highlights from The GSMA Innovation Fund for Climate Resilience and Adaptation</u>". GSMA Mobile for Development Blog.

Smallholder farmers: Vital yet vulnerable







Smallholder farmers produce more than

30% of the world's food and up to

nu‰

of food consumed in Asia and Sub-Saharan Africa¹⁸

Smallholders **provide** livelihoods for more than

้ บบบท households globally¹⁹



and account for



of the 1.1 billion extremely poor living on less than \$2 a day.²

Hafiz, S. (13 February 2024). "<u>Trends in Innovation Pitches: Opportunities for Climate Tech Investment</u>". GSMA Mobile for Development Blog.
 Climate-smart agriculture charts development pathways that achieve three interlinked goals: increased productivity and profitability, adaptation to climate change and mitigation of climate change. See: GSMA. (2022). <u>Data-driven advisory services for climate-smart smallholder agriculture</u>.

What have we learned from our agritech startups?

Funding is critical for advancing agritech innovations that tackle pressing challenges in sustainable farming and food security. During the first round of the GSMA Innovation Fund (2022-2024), six agritech startups from Ethiopia, Nepal, Nigeria and Pakistan received support to develop, test and scale commercially viable digital agriculture solutions that improve the climate resilience and incomes of smallholder farmers.

Since the first round of grant funding ended in 2024, the GSMA has worked closely with agritech grantees to understand the challenges and opportunities they face, while also navigating the complexities of creating high-impact mobile and digital agriculture solutions. This is what we've learned:

Frontier tech shows promise in improving existing agritech services. Advanced technologies, particularly AI, have been used successfully to improve existing offerings, especially the accuracy of weather forecasting and, in turn, more targeted advisory services. This chain of improvement - from better forecasts to enhanced farmer knowledge and changes in agricultural practices - ultimately boosts yields and strengthens climate resilience. As a subset of AI, machine learning has also

enhanced capabilities in offerings from Hello Tractor and Crop2Cash, making these solutions more accessible and equitable.

2 Effective engagement with smallholder farmers hinges on accessible and inclusive delivery channels. While advanced technologies like AI can power back-end systems, front-end solutions must be approachable, especially for farmers with lower literacy levels. Audio-visual content, such as interactive voice response (IVR) and videos, has proven to be particularly engaging for women and those with limited literacy. For example, both **BKK** and **Lersha** found that their call centres were the most popular channels for seeking and clarifying information, highlighting the importance of voice-based solutions and opportunities to seek clarification and ask questions. Similarly, **CoAmana** found a strong preference among rural women for call centres over USSD services - evidence that audio-visual solutions are still relevant. A phased approach in which farmers are introduced to digital solutions gradually, while retaining familiar voicebased channels, can foster trust and ease the transition. This balance ensures that advanced technologies powering the back end can amplify the reach and impact of user-friendly front-end channels, laying the groundwork for broader digital adoption over time.

3 Community agents have a multiplier effect.

The importance of human touch in agritech adoption cannot be overstated. For all agritech grantees, community-based agents were key to successful adoption of their solutions. Agents not only help customers with onboarding and improving digital literacy, but also play a vital role in building the trust necessary for farmers to embrace tech solutions and the startup's services. The transition to digital platforms can be challenging, and trust built through personal interactions is crucial for these innovations to take root and be a force for change.

4 Strategic partnerships have been instrumental in grantees achieving scale. This was particularly evident in the experience of **BKK** in Pakistan. All grantees have relied on partner organisations in some capacity to reach target users and expand their user base. For example, GeoKrishi exceeded their user targets by nearly 30% through collaborations with partners like cooperatives and agribusinesses, highlighting the power of partnerships to drive adoption of tech solutions and reach more smallholder farmers.

More men use agritech solutions, but women's participation is increasingly vital. Cultural barriers, such as those observed by **CoAmana**, can hinder adoption by female farmers and limit their involvement. This

Meet the GSMA agritech startups - Cohort 1



Bakhabar Kissan (BKK) | Pakistan

Strengthening agricultural productivity and planning for climate-vulnerable farming communities in Pakistan. A network of new weather stations provides hyperlocal weather information and gives farmers access to agricultural expertise through digital platforms.



CoAmana | Nigeria

Improving agricultural productivity and helping farmers to manage financial risks related to drought in Nigeria. A digital marketplace enables farmers to access markets, purchase drought-resistant seeds and access information on best practices and financial services.



Crop2Cash | Nigeria

Supporting farmers facing drought conditions in Nigeria to manage financial risks and adapt their farming practices. Farmers have access to agricultural insurance and climate-smart farming content through a mobile app, as well as high-yield, drought-resistant maize seeds through a USSD²⁴ channel.

24. USSD (Unstructured Supplementary Service Data) is a Global System for Mobile Communications (GSM) protocol that is used to send text messages. USSD is similar to Short Message Service (SMS). USSD uses codes made up of characters available on a mobile phone

Ge9Krishi

GeoKrishi | Nepal

Helping smallholder farmers adapt to climate stressors and adopt climate-smart agricultural practices through digital learning content and advisory services.



Lersha | Ethiopia

One-stop digital service for smallholder farmers that provides advisory content on climate-smart agriculture solutions and weather information and facilitates access to agricultural credit and insurance.

The GSMA agritech startups - Cohort 1





underscores the need for targeted approaches. Some grantees, like **BKK**, have introduced female-focussed content (such as kitchen gardening) to make their solutions more appealing and accessible to women. Others have adapted their channels to focus on IVR and call centres, or engaged women through in-person capacity-building workshops.

Innovative business models improve access to 6 agritech. Various business models have proven successful among grantees. **BKK's** subscription model has increased profits, CoAmana's flexible options, such as Lease to Buy and Buy Now, Pay Later, have boosted community access to assets and Hello Tractor's PAYG model has democratised tractor ownership. These tailored financial solutions not only remove access barriers to assets, but also accelerate agritech adoption, promote longterm sustainability for farmers and increase profits for startups.

Each startup supported by the GSMA Innovation Fund has made strides in refining their solutions, addressing critical barriers and leveraging lessons learned to enhance the impact and sustainability of their innovations. Four of these journeys are detailed on the next page.



Hello Tractor | Nigeria

Improving planning and preparedness for farming communities facing unpredictable rainfall patterns in Nigeria. A weather and tractor service uses demand data to model and optimise the provision of tractor services.



Case study

Scaling to 12 million farmers in Pakistan through partnerships with leading MNOs

BaKhabar Kissan (BKK) received funding from the GSMA to enhance their digital weather platform and provide smallholder farmers with real-time, hyperlocal weather information. The GSMA grant helped BKK launch 155 new automated weather stations across agricultural centres, mainly in underserved rural areas of Pakistan. By incorporating **AI algorithms** for data analysis and pattern recognition, the startup could offer more **accurate and** timely forecasts, further improving resilience to weather-related challenges.

BKK rapidly scaled their operations through strategic partnerships with Jazz and Zong (major mobile operators in Pakistan). These collaborations significantly boosted subscriber growth by leveraging the existing customer base of the MNOs. During the grant period, BKK successfully **onboarded** an additional 6 million users, bringing their total user base to more than 12 million farmers.

Read the full case study here.

casts that predict rain, we save a substantial amount of money that would otherwise be spent on irrigating our fields. It is not just about that, it is also about when to apply pesticides. We save money on these activities based on BKK's advisory and increase our income margin.

By following the BKK fore-

" Farmer using BKK services

Ge9Kr ishi

Case study

weather data

With support from the GSMA, GeoKrishi strengthened their advisory services to help farmers in Nepal tackle the climate-related challenges they face. Through their digital agriculture platform and partnerships with local communities, GeoKrishi provided vital support to more than 51,000 smallholder farmers, 57% of whom were women - a rare example of a startup effectively engaging and supporting female farmers.

GeoKrishi's hyperlocal weather information proved to be particularly effective in helping farmers plan and prepare. Our endline analysis found that GeoKrishi's weather app significantly improved the ability of farmers to anticipate climate shocks, as evidenced by 97% of users who reported better anticipation of major weather events, and 94% who found the app valuable for accessing local weather information. These findings indicate the app's effectiveness at providing relevant data for farmers to prepare and plan.

Read the full case study here.



Case study

Unlocking access to finance for smallholder farmers in Ethiopia

The Lersha platform is a one-stop digital service for Ethiopian smallholder farmers. It provides advisory content on climate-smart agricultural practices, weather information and access to agricultural credit and insurance.

With support from the GSMA, Lersha piloted agricultural finance and climate-risk insurance products, gaining valuable insights into how to engage credit solutions gradually increased. The pilot tested with banks and insurers, and a better understanding of how farmers come to adopt new financial products.

The pilot revealed a key challenge: financial institutions have strong reservations about serving smallholder farmers due to the perceived high risk. In response, Lersha developed detailed farmer profiles and a credit-scoring model to increase confidence among financial institutions.

Farmers, meanwhile, were initially reluctant to use Lersha's credit services. This stemmed from low awareness of the products and conflicts with Islamic principles. Qualitative interviews revealed that many farmers avoided credit due to religious prohibitions against paying interest but were more open to insurance. With support from agents, partners and the government, interest in Lersha's bundled microloans of approximately \$430 each, which despite their modest size, were well received among farmers.

Lersha navigated these challenges successfully, onboarding eight financial service providers and enrolling nearly 20,000 farmers. These farmers gained better access to bundled insurance and finance, with insurance premiums totalling approximately \$880,000 and covering 22,100 hectares of land.

Read the full case study here.



Case study

farmers in Nigeria

The GSMA grant supported CoAmana's Amana Market, a marketplace platform that provides smallholder farmers in Nigeria facing drought conditions with access to an ecosystem of buyers, input and equipment providers, information on adaptive agricultural practices and financial services. In the past, we used

During the grant period, CoAmana piloted a project to introduce nine solarpowered irrigation pumps to women farmers in northern Nigeria on a leaseto-own model. This initiative aimed to boost their financial independence and enhance agricultural productivity during the dry season. By opting for solar-powered pumps over diesel alternatives, the farmers benefit financially through lower energy costs and contribute to environmental sustainability. The lease-to-own model also allows initial lessees to sub-lease the pumps to to worry about all of that other community farmers, spreading the benefits and offsetting costs.

Despite persistent cultural and normative barriers that limit women's access to Female farmer technology, the pilot has been well received in the country. With a significant gender gap in mobile ownership and internet use in Nigeria, CoAmana's gender-sensitive approach is crucial for overcoming these challenges and improving access to vital agricultural resources.²⁵

Read the full case study here.



Digitalising agriculture in Nepal through hyperlocal



Now equipped with forecasted weather information *in advance, we can take* precautionary and proactive measures to safeguard our property and crops.

Female farmer, 35 years



Piloting solar-powered irrigation for female

fuel-powered water pumping machines. We were always worried about the cost of buying fuel, repairs and servicing the machines. With the CoAmana Solar Irrigation Pumps, we don't have anymore.



Investment Readiness: A toolkit for agritech innovators

Access to funding is vital for digital agriculture solutions to develop and scale. However, early-stage agritech startups with limited traction and revenue often face significant challenges in securing external investment. To overcome these hurdles, agritechs need a deeper understanding of investor priorities, as well as guidance on navigating the fundraising process and positioning themselves to attract investment.

To address this need, the GSMA AgriTech programme developed *Investment Readiness: A Toolkit for Agritech Innovators*. This toolkit offers actionable advice to help agritechs become more investment-ready and successfully navigate the fundraising journey.

Funding gaps limit the growth of agritechs in LMICs



Agritech receives just

of venture capital (VC) funding: Despite its potential to tackle food insecurity and climate change, investment in digital agriculture remains far below what's needed.²⁶



Investment is skewed towards developed markets: In 2023, LMICs in Africa, Latin America and Asia attracted just





of agritechs rely on bootstrapping, limiting growth:

Only 2% of solutions reach more than a million users due to restricted access to capital.

Investor interest in climate solutions is growing rapidly



Increasing focus on climate tech solutions: Funding for solutions that enhance farmers' resilience to climate shocks and support adaptation is on the rise, with

\$ 5.7billion

raised since 2012. Even so, climate adaptation continues to be underfunded.²⁷



Investors view AI as a promising tool

for enhancing agricultural precision and efficiency but remain cautious of its hype, seeking genuine value and impact from agritech solutions.

Investors are shifting focus from farmer-only

models to ecosystem-based approaches that address value chain inefficiencies and involve agribusinesses, recognising the affordability challenges of B2C solutions.

Key stages of an agritech fundraising journey



Empowering agritech grantees with bespoke technical assistance

Hands-on guidance is essential to bridge the gap between technology and real-world adoption. The GSMA AgriTech Accelerator recognises this critical need, offering technical assistance to startups to ensure their solutions not only scale, but also drive transformative change in agricultural communities. Delivered on behalf of Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), the programme supports digital agriculture solutions that leverage mobile technology to improve smallholder farmers' livelihoods, enhance climate resilience and foster financial inclusion with a focus on equitable access for women, young farmers and farmers with disabilities. Learn more about the activities and cohort members <u>here</u>.

 GSMA analysis from: Teare, G. (4 January 2024). "Global Startup Funding In 2023 Clocks In At Lowest Level In 5 Years". Crunchbase; AgFunder. (2024). <u>Global AgriFoodTech Investment Report 2024</u>.

27. AgFunder and ISF Advisors. (2024). Climate Capital: Financing Adaptation Pathways for Smallholder Farmers.





What's next?

While we've seen notable progress in funding for agritech innovations, significant challenges remain. Growing demand for sustainable agricultural solutions is likely to outpace supply, especially as climate change exacerbates pressures on global food systems. The sector requires a more comprehensive approach that goes beyond technological solutions and emphasises regenerative agricultural practices over extractive methods.

With global financing for regenerative agriculture predicted to increase significantly in 2025,²⁸ our focus in the second round of the GSMA Innovation

Fund for Climate Resilience and Adaptation will be on supporting tech solutions that strengthen soil health and ecosystem restoration while also delivering biodiversity and community benefits. To facilitate this shift, we must advocate for policy reforms that offer tangible incentives for sustainable farming, support the development of climateresilient infrastructure and ensure that smallholder farmers, who are at the front line of environmental challenges, receive targeted and practical support to thrive in a changing climate. Meanwhile, we continue to monitor the impacts of emerging global policies on agritech, with particular attention to the EU Regulation on Deforestation-free Products (EUDR) featured in the next Spotlight.

Meet the GSMA agritech startups - Cohort 2



<u>Aloi</u> | Nepal

inQube

InQube | India

Enhancing smallholder

farmers' incomes through farm

decision support, supply chain

enablement and regenerative

farm practices with a service

technology (SaaS) platform.

Supporting dairy farmers to adopt climate-smart agroforestry practices while strengthening financial inclusion through a cashless digital financing solution.



<u>BizyTech</u> | Tanzania

Advancing sustainable agriculture with bespoke agronomic advice for smallholder farmers to enhance soil quality, yields and incomes through AI-powered satellite imagery.

Empowering farmers to adopt

practice regenerative agriculture

with capacity building content.

digital market access and

SenzAgro | Sri Lanka



Crop2X | Pakistan

Providing farmers with real-time data and actionable insights to optimise agricultural productivity with AI.



UjuziKilimo | Kenya

Transforming smallholder farming with precision agricultural technology, leveraging IoT and data-driven decisions.

28. Cox, T. (21 August 2024). "Regenerative agriculture finance to mobilise at scale in 2025, says executive". Carbon Pulse.





Spotlight

Exploring EUDR: A boon for agritech innovation, but will it leave smallholders behind?

Agriculture is a major driver of climate change. accounting for a third of greenhouse gas emissions and causing nearly 90% of global deforestation through expansion.²⁹ Key commodities such as beef, palm oil, sovbeans and cocoa are often linked to forest loss. leading to increased carbon emissions, biodiversity loss and global warming.

Recognising the vital role of forests in combating climate change and biodiversity loss, governments worldwide are imposing regulations to restrict the trade of products tied to deforestation. In 2023, the European Parliament passed new regulation to prevent imports from recently deforested land or imports that have contributed to forest degradation.³⁰

The traditional pen-and-paper methods used for tracking the source of produce in the agricultural last mile are ill-suited for the stringent traceability requirements of EUDR and other similar regulatory frameworks. Robust digital solutions are needed to collect, store and share information about the commodity's source. This includes geolocation information on the plot of land from where the commodity originated, buyer information, risk assessments and due diligence statements.

Over the past decade, an increasing number of agritechs in LMICs have developed digital solutions for supply chain traceability. With EUDR scheduled for implementation in 2025,³¹ many of these agritech innovators, particularly in regions where deforestationlinked crops are cultivated, like West Africa and Southeast Asia, are iterating their solutions to meet the new regulations. A combination of innovative technologies can be used to ensure EUDR-compliance, for example:

- Distributed ledger technologies, such as blockchain, that create a secure, shared ledger that all value chain actors (farmers, processors, retailers) can access and verify information about the product's journey, preventing data tampering
- Electronic tracking methods, such as QR codes and RFID tags, which enable easy scanning and real-time tracing throughout the supply chain
- Satellite imagery pinpointing farm geospatial coordinates that verify historical land-use practices and compliance with deforestation regulation

EUDR's traceability requirements create significant opportunities for agritechs to innovate and leapfrog the adoption of digital solutions in agriculture. For example, GSMA grantee J-Palm developed a mobile blockchain-enabled solution for full supply chain traceability from palm fruit to palm oil in Liberia. Meanwhile, eProd uses a mobile app to map farmer fields using GPS, gather farmer data and track produce using QR codes. The agritech is also piloting the use of satellite data on cocoa farms in Côte d'Ivoire to identify areas prone to deforestation. Another company, Interu, leverages their bespoke distributed ledger technology to collect traceable data points between value chain participants. They are also building a mobile app to capture the GPS coordinates of farms and other EUDR-required data points (crop type, farmer name, etc.).

While these solutions offer promising benefits, they come with considerable financial and resource demands, including software and equipment acquisition, capacity building and human resources. These costs can create market access barriers for smallholder farmers and agribusinesses with limited financial and technological means. To ensure that small commodity traders - and the smallholders they source from - are not left behind, targeted efforts are needed.

Multistakeholder collaborations between agritechs, NGOs, donors and investors can provide catalytic funding and technical assistance to increase the adoption of traceability technology by agribusinesses, cooperatives and farmers, and enable them to navigate the new rules, continue participating in international trade and safeguard their livelihoods. While deforestation-linked regulations like EUDR can trigger innovation and more sustainable practices throughout key agricultural supply chains, their effectiveness in combating climate change hinges on equitable implementation and the participation of all stakeholders.

Read the full blog to learn more about the GSMA's take on EUDR.

30. European Commission. (n.d.). "Regulation on Deforestation-free Products" 31. 30 December 2025 for large and medium companies, 30 June 2026 for o and small comp







^{29.} Conservation International. (n.d.). "Deforestation facts".

6. Circularity

Tackling the growing global waste challenge

Amid rapid urbanisation and population growth across LMICs, waste generation is outstripping population growth and escalating faster than infrastructure can handle. By 2050, the total amount of waste generated is expected to triple in Africa and double in Asia,³² threatening significant impacts on people, ecosystems and the climate.

In the face of this mounting challenge, momentum is growing for policy reforms at global and national levels, poised to transform markets and create new opportunities. Extended producer responsibility (EPR) policies, which hold producers accountable for the end-of-life management of their products, are among the most influential tools available.

While progress has been gradual, more and more countries are adopting new measures to tackle waste management. India, Indonesia, South Africa, Kenya and Ghana have all recently signed into law EPR policies governing plastics and e-waste. Meanwhile, rising demand for secondary materials, driven by limited global supplies of critical inputs and higher battery prices, is making e-waste a more valuable resource.

E-waste is the fastest growing

major waste stream with only of electronics

recycled³³





Despite an increased focus on circular economy approaches and recycling, the proportion of materials in the global economy cycled back into use fell from



32. UNEP. (2024). Global Waste Management Outlook 2024.

- 33. ITU and UNITAR. (2024). Global E-waste Monitor 2024.
- 34. GIZ. (2020). Stop Floating, Start Swimming: Water and Climate Change Interlinkages and Prospects for Future Action.
- 35. Circle Economy Foundation. (2023). The Circularity Gap Report 2023.
- 36. For details, see: GSMA. (2021). Digital Dividends in Plastic Recycling



Less than of the world's plastics are recycled³⁶

The <u>GSMA Innovation Fund for Digital</u> <u>Urban Services</u>, which concluded in 2023, supported several projects working at the intersection of digital innovation and waste management:

The Freetown Waste Transformers

Freetown Waste Transformers in Sierra Leone

turns organic waste into electricity, replacing diesel generators with green technology to reduce the cost of energy and increase the reliability of energy and heat. Their biogas digesters use organic waste collected from households in Freetown.



ReCircle, based in **India**, has built a traceable reverse supply chain and sells EPR credits to businesses. With their tech-enabled platform ClimaOne, ReCircle provides blockchain-assured traceability and complete visibility across the supply chain, from sourcing to disposal.



Regenize delivers household recycling solutions in **South Africa** through an app-based service with virtual currency and a network of decentralised recycling hubs.



<u>Soso Care</u> in **Nigeria** delivers microhealth insurance to customers and waste aggregators, using waste as a partial payment for premiums.

Innovations and startups disrupting circularity

Analysis by the GSMA shows there is a vibrant and growing startup ecosystem in waste management attracting sizeable investments across LMICs, with series raises in the tens of millions becoming increasingly common. Against the backdrop of waste management reforms, digital innovations are enabling more effective service delivery and providing policymakers and regulators with stronger oversight and enforcement mechanisms.

In our report, <u>Making Circularity</u> <u>Work: How digital innovation enables</u> <u>circular economy approaches in waste</u> <u>management</u>, the GSMA Digital Utilities programme showcases innovation at all stages of the waste management value chain, from connecting households to informal collectors, to ensuring waste pickers work in safe conditions and are fairly remunerated, to tracking waste through the value chain.

The report delved into real-world applications of how to leverage technology to enhance waste management. The experiences of the GSMA Innovation Fund for Digital Urban Services grantees revealed the pivotal role of partnerships in scaling techdriven solutions, the barriers created by the digital usage gap and the diverse effects of EPR legislation on their progress and impact.

Here's a snapshot of some promising mobile and digital solutions featured in the GSMA's <u>Making Circularity Work</u> report



Mobile app-based systems are improving the coordination of household waste collection.

Tokenisation and blockchain technologies are providing credibility for legislative compliance as accountability measures for waste management become more stringent.



Al and machine learning are rapidly advancing and being used to identify and analyse waste stream components and patterns. When combined with robotics at centralised facilities, these technologies can fully automate waste segregation.

Digital product passports are digital records of the value chain of an item, including the material, production processes and recommendations for end-of-life disposal. While more common in the EU, they are poised to strengthen solutions in LMICs.







IoT and other sensing devices are being used to monitor the fill levels and status of waste containers, improving waste collection logistics and ensuring prompt service. When combined with GIS and vehicle tracking, this data can also optimise collection routes.



Remote sensing, payment data and digitised collection can support data-driven decisions and address data scarcity in urban planning and policy development across LMICs.



Mobile payments help

encourage behaviour change among customers and can benefit waste pickers by helping them build a credit history and improve access to financial services. Case study

Scaling impact through strategic partnerships in Sierra Leone

The GSMA supported Freetown Waste Transformers (FWT) to digitalise waste collection and improve the efficiency of waste coordination using a mobile GPS mapping app.

The grant revealed that strategic partnerships with key players are crucial to scale. FWT's collaboration with Freetown City Council improved waste management by streamlining automatic collections and payments through the FTW app. An alliance with the Waste Collectors Management Association facilitated training for waste collectors, while partnerships with Africell Sierra Leone and Orange Money Sierra Leone enabled mobile payment options to be integrated in the app.

Africell's involvement extends to purchasing energy from waste transformer units, highlighting **the additional benefits of these partnerships** for waste management efficiency.

Case study

Tighter EPR legislation can be market-making in India

ReCircle used the GSMA grant to develop and launch their ClimaOne platform, which provides end-to-end traceability of a company's plastic material and issues EPR plastic credits. The platform allows large plastic producers to take control of their sustainability targets at the click of a button and comply with India's EPR laws.

The EPR legislation significantly shaped ReCircle's business model, enabling them to drive revenue through the sale of plastic credits.

The Central Pollution Control Board's updated guidelines, which require producers and brands to purchase credits equivalent to their plastic use, created more reliable demand for these credits.

As a result, ReCircle onboarded 23 clients during the grant period (now up to 32), including major brands like Hindustan Unilever, Dabur, Hindustan Coca-Cola Beverages and Nestlé.

Circularity and the mobile industry

GSMA research estimates that around 5 billion mobile phones are lying dormant around the world. To tackle this waste stream, the GSMA has been working closely with MNOs to reduce the environmental impact of mobile phones through reuse, repair and recycling.

The GSMA's <u>circularity strategy for the mobile industry</u> lays out principles to help achieve the industry vision for circularity by 2050. It is based on two overarching concepts: maximised longevity and zero waste.

Recent consultations with MNO sustainability teams revealed that circularity is a growing internal priority, with waste management now ranked in the top three focus areas for 2025. This shift has been driven largely by new regulatory requirements, particularly EPR in key markets, as well as broader corporate sustainability commitments.

The GSMA waste hierarchy for mobile devices and network equipment

GUIDELINES







ClimateTech Horizons







The GSMA launched two major initiatives in 2024 to help accelerate circularity in the mobile industry.

- 1. The <u>GSMA Equipment Marketplace</u> was launched – the first global digital marketplace to source and resell preowned network equipment – bringing together buyers and sellers from the telecommunications ecosystem.
- Commitments to improve <u>mobile</u> <u>device circularity</u>. As of January 2025, 16 global MNOs representing a billion mobile connections have signed on to GSMA targets to increase the take-back of mobile phones and ensure they are reused or responsibly recycled.

eded? If yes, ⁄, disassembly, repair.	Avoid CapExEquipment lifetime years
cation. ssibly recertification.	% equipment reusedResale revenue \$
and then reuse. ne product.	% equipment reusedResale revenue \$
omponents and ducts.	% equipment recycled
als through physical and to reuse as feedstocks.	% equipment recycled
y residual or hazardous Ifill or incineration.	% equipment landfilled
er pollution (e.g. littering). sources (e.g. burning).	Number of pollution incidents/fines \$

EXAMPLE METRICS

43/84



Old devices with a new lease on life

In 2024, the GSMA conducted a survey of more than 10,000 mobile phone users in 26 countries - representing 70% of the global population - to understand how people are buying, using, repairing and disposing of their mobile phones. The findings shine a light on how people value their phones and how the industry may need to respond to changing needs. The survey found that:

vears



of respondents had at least one old phone at home not in regular use and nearly half (46%) have at least two old phones.

The average age of phones before replacement is around

with the vast majority of phones (75%) lasting between one and three years.

Almost



of consumers expect to purchase their next phone within the **next two years**.



using their phones for more than three years.

The **top two factors** driving respondents to replace their phones are battery life (very important for 90% of consumers) and poor performance/ slowing down (87%).



said they would replace their phone just to get **the** latest model.

We know that reusing or refurbishing a phone can reduce the environmental impact of a new phone by <u>around 90%</u>. The refurbished device market is thriving, with more than 200 million used smartphones sold in 2023 - a 6% increase from 2022. This growing market highlights the rising consumer demand for more sustainable options, as well as the potential for circular economy models to reduce waste and conserve resources.











ClimateTech Horizons



Several MNOs are pioneering e-waste solutions in LMICs:

- In Sri Lanka, Dialog launched the island-wide e-Kunu Programme for responsible e-waste management
- In the Philippines, Globe has collected and recycled 216.7 metric tonnes of e-waste in the past decade
- In Kenya, Safaricom has expanded its take back of end-of-life devices while transitioning to e-SIMs to reduce waste

Powering circularity through collaboration

We've seen that both startups and MNOs play a crucial role in supporting innovation for circularity, but they cannot achieve it alone. Public-private partnerships are vital for translating global and national reforms into local action and unlocking the full potential of the circular economy. While it can be challenging to build these partnerships, they allow startups and MNOs to combine their strengths and improve the quality and reliability of waste management.³⁷ These collaborations help the public sector save money, reduce risks and enhance services, while enabling private companies to recover costs and expand sustainable waste management practices. This year, the GSMA facilitated a promising new partnership between a startup and an MNO in Kenya, as detailed in the Spotlight on the right.

Partnering with the Public Sector: A toolkit for startups in the utilities sector

This GSMA toolkit provides a conceptual framework for startups to identify, frame and establish public-sector partnerships to tackle waste management (and beyond).



Partnering With the Public Sector: A toolkit for start-ups in the utilities sectors

What's next?

Current recycling and reuse rates show there is still a long way to go in building a truly circular economy. As global legislation tightens, markets and solutions focussed on circularity will gain momentum. GSMA analysis shows that mobile and digital platforms are in a prime position to improve services, encourage behaviour change and enhance accountability and traceability to create more effective and equitable circular models.

Spotlight Safaricom and Taka Taka Ni Mali: Piloting smart waste management in Kenya

Sub-Saharan Africa faces significant waste management challenges, with approximately 62 million tonnes of waste are generated a vear.³⁸ A new partnership between Safaricom and Taka Taka Ni Mali (TTNM). established in 2024 with support from the GSMA, is piloting an innovative smart waste management model in Kenyan cities.

The startup: Taka Taka Ni Mali

TTNM is a female-led, for-profit social enterprise committed to transforming waste management in Africa. The startup's circular economy approach focusses on integrating technology in waste management practices. TTNM's core offering is a mobile app that connects waste collectors with households and businesses. In 2023, they launched the Ecoloop platform, an integrated waste regeneration ecosystem that tracks the movement and conversion of waste and assesses its environmental impact.

The MNO: Safaricom

For Safaricom, the largest telco in Kenya, circularity has been moving up the agenda since the introduction of the country's EPR policy in 2022.³⁹ Recognising the potential of technology to address waste management issues, practices and provides a valuable Safaricom entered a partnership with TTNM to develop and test their startup partnerships to create IoT solutions.

The collaboration between Safaricom and TTNM aims to strengthen the Ecoloop platform by leveraging Safaricom's extensive mobile phone infrastructure, IoT technology and mobile money API. This integration is designed to enable businesses and institutions to access waste management services through mobile apps and make digital payments via mobile money. By doing so, it will create a comprehensive smart waste management ecosystem involving businesses, institutions, waste collectors, material recovery facilities, recyclers and Producer **Responsibility Organisations** (PROs). The pilot project is set to run for one year, with plans to expand the partnership to other cities in Kenya - and potentially across Sub-Saharan Africa - to address waste management

Pioneering change

The Safaricom-TTNM partnership is well positioned to transform waste management in Kenya. By supporting environmental conservation and sustainable economic growth, and strengthening the evidence for smart city initiatives, this collaboration sets a new benchmark for circular economy case study for other MNO and innovative circularity solutions.

37. GSMA. (2022). Catalysing Partnerships in Plastics.





A new partnership

challenges on a larger scale.

^{38.} Idowu, I.O. et al. (2019). "An analyses of the status of landfill classification systems nent, 87, pp. 761-771

^{39.} Dr Ayub Macharia Ndaruga, Ministry of Environment, Climate Change and Forestry.

7. **Nature**

As the rapid decline of nature endangers ecosystems, species and the very foundation of life on Earth, the world remains far short of the ambitious biodiversity targets set under the Kunming-Montreal Global Biodiversity Framework.⁴⁰ Despite commitments made by 196 countries in 2022,⁴¹ 85% of countries missed the United Nations deadline to submit nature pledges by COP16. Many are struggling to implement effective policies, and biodiversity continues to decline at alarming rates. Efforts to reverse this trend have been complicated by the need for substantial financial investments and coordinated international action, which have not yet fully materialised.

The emergence of "nature tech" solutions, which harness technology to protect and restore biodiversity, offer new hope.⁴² Although still in early stages, the market is experiencing rapid growth. Currently valued at \$2 billion, it is projected to reach \$6 billion within the next decade, playing a potentially critical role in tackling the biodiversity challenge.⁴³

While numerous mobile and digital solutions are being leveraged worldwide - including several GSMA Innovation Fund grantees - most of these startups are still in early stages and rely heavily on grant funding. A clearer understanding is needed of viable business models and revenue streams that can direct financing to these solutions and help them to scale.

Meet the GSMA nature startups

Supporting water resource

management using **loT** to

help convert wastewater into

irrigation water for small farms in

BENAA, Egypt

rural Egypt.







Creating a regenerative model for positive social, ecological and economic change, through a **traceability** app and tree health app.



<u>J-Palm,</u> Liberia

Dayaxa, Somaliland

Transforming the sustainability of wild palm oil through access to ecological information for local harvesters, as well as mobile **blockchain** technology for improved **traceability**.



<u>Monsoon Tea Company</u>, Thailand

Improving forest biodiversity and empowering tea farmers through a **traceability** mobile app.



<u>Sommalife</u>, Ghana

Improving the climate resilience and incomes of female shea farmers by improving the **traceability** of the shea value chain through digital software.

40. The Convention on Biological Diversity. (2024). Global Biodiversity Outlook

- 41. IPBES. (25 November 2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services.
- 42. "Nature tech" refers to any technology that enables, accelerates and scales the nature-positive trans
- 43. World Economic Forum. (2023). *Biodiversity Credits: Demand Analysis and Market Outlook*.



The emergence of "nature tech" solutions, which harness technology to protect and restore biodiversity, offer new hope

Biodiversity Business Model: Example combinations



Source: GSMA. 2024. The Nature Tech Nexus: Bridging biodiversity and business

GSMA

50/84

GSMA

ClimateTech Horizons

In the GSMA ClimateTech report, <u>The Nature Tech Nexu</u> <u>Bridging biodiversity and business</u>, we analysed promis business models for bolstering the nature tech startup ecosystem and identified potential revenue streams to facilitate scaling beyond grant support.

As shown in the Biodiversity Business Model diagram, t are countless possibilities to mix and match technologie use cases and revenue streams. The vast majority (90% biodiversity projects analysed use at least two technologie and draw from multiple revenue streams. Many startup are experimenting with combinations of revenue stream and technologies, offering diverse products to various stakeholders and attracting clients from a range of sect

Opportunities for innovators are vast, and startups show identify the optimal combination of approaches for the particular use case and context.

While many tried-and-tested biodiversity models have potential for growth, our research identified several mo promising use cases, technologies and revenue streams to scale nature tech in LMICs:



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Key use cases: Reporting and disclosure, supply transformation, corporate target setting, biodiv offsetting and project development and manag

Key revenue streams: Data services, biodiversit credits, payment for ecosystem services



Transformative technologies: Monitoring, reporting and verification (MRV) and AI.

The GSMA at COP16



Financing Nature-Based Solutions in Africa: Strengthening the investment environment

In 2024 the GSMA ClimateTech programme participated in COP16 in Cali, Colombia to discuss how targeted investment can unlock the potential of nature-based solutions in Africa. The discussion explored revenue streams that can help nature tech startups transition from reliance on grant funding to a more sustainable, commercial footing. This included:

<u>ıs:</u> sing	The GSMA Innovation Fund: Supporting nature tech startups
there es, 6) of ogies	The GSMA has been supporting nature- tech solutions across Africa and Asia through the GSMA Innovation Fund for Climate Resilience and Adaptation, supporting startups across the water management, forestry, sustainable palm oil and frankincense supply chains.
ns	With regulations like the Corporate
tors.	Sustainability Reporting Directive (CSRD) and frameworks such as the Taskforce on Nature-related Financial
ould eir	Disclosures (TNFD) coming into play, large corporations will soon need to report and manage their nature- related impacts and dependencies. This growing emphasis on supply chain
ore s poised	traceability reflects a rising demand: suppliers want to prove their products are sustainably and ethically produced, while companies strive to demonstrate
y chain versity gement	progress on their traceability and sustainability commitments. Tech innovations in traceability have been a
ty	key focus of our nature tech grantees. See the following case studies to learn how two different traceability apps fared in Somaliland and Liberia.
ortina	

- 1. **Data services:** With the increasing demand for highquality data in project development, there's a strong opportunity for data and platform providers to leverage SaaS solutions to meet these needs.
- 2. **Biodiversity credits:** A hot topic at COP16, biodiversity credits are gaining traction as a future revenue stream, with potential for innovators to support transparency in this emerging market.
- 3. **Payment for Ecosystem Services (PES):** By leveraging tech solutions, PES schemes can evolve beyond traditional methods, linking mobile money payments to measurable outcomes and unlocking new revenue streams that benefit both ecosystems and local communities.

Case study

Transforming frankincense supply chains with blockchain in Somaliland

The Dayaxa Frankincense Export <u>Company (DFEC)</u> is a startup focussed on harvesting frankincense in rural Somaliland more sustainably. With support from the GSMA Innovation Fund. Dayaxa successfully launched two apps during the grant period: a traceability app and a tree health app.

DFEC developed their traceability app using blockchain to pinpoint the source of frankincense resin, track payments to farmers and follow the journey of the resin from rural Somaliland to processing in the UK. The app is designed to improve transparency, ensure fairer compensation for farmers and guarantee quality for international buyers.

With more than 1,300 users now on the platform, Dayaxa's traceability app helped secure a significant commercial deal with a U.S.-based company by showcasing the value of sustainably sourced, traceable

frankincense. Meanwhile, the tree health app supports sustainable land management by monitoring harvesting practices and tree health.

Dayaxa's technological solutions have also created new economic opportunities for farmers. By eliminating intermediaries and charging buyers a premium for the traceable product, DFEC guarantees that harvesters receive fair prices (increasing from around \$2 to \$5 per kg, with a target of \$7). Harvesters reported that Dayaxa's buying process was straightforward and payment was prompt, which provided them Farmer with immediate liquidity when needed.

Challenges remain, particularly in securing new clients in an industry that moves cautiously. However, DFEC is a leading example of a profitable business selling traceable resins, proving that this tech can deliver meaningful benefits to both farmers and the industry.



Most frankincense buyers don't care. they send agents who pay us little or only in food ... we need fair and direct relationships with buyers like Dayaxa.

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Quantifying Nature's Footprint: The challenge of measuring biodiversity

Measuring biodiversity is notoriously difficult. But, it is essential for startups to share with investors and buyers, who rely on quality data to assess the impact of their financial contributions. Without accurate measurements and metrics, it becomes more challenging to make informed decisions and implement effective practices.

So, how can we measure the impact of nature-tech solutions on biodiversity? Given the complexity of ecosystems, there is no one-size-fits-all approach. In the second round of the GSMA Innovation Fund, we are supporting the development of customised methodologies in collaboration with naturetech startups. Through bespoke biodiversity assessments, we hope to refine the accuracy and effectiveness of tech solutions to ensure they genuinely contribute to ecosystem health.

Learn more about our bespoke approaches here.

While still in its infancy, the nature tech market is clearly gaining momentum. The steady advancement and adoption of mobile The mobile industry has significant potential to and digital solutions in LMICs, coupled with combat biodiversity loss - an increasingly businessincreased awareness of biodiversity risks and the critical issue. MNOs have a unique opportunity - not implementation of disclosure policy frameworks, only to drive innovation in nature tech, but also to will continue to drive demand. However, the growth enhance their own sustainability by engaging more of the sector will depend on how guickly capabilities deeply in biodiversity initiatives. The formation of develop - especially in accurately measuring the GSMA Biodiversity Project Group is a vital step biodiversity across diverse regions and over time towards understanding and mitigating biodiversity - and the strength of regulatory frameworks for impacts through a unified approach. By integrating disclosure and action. The ability of the private biodiversity commitments in core business sector to demonstrate the tangible impacts of strategies and exploring how nature tech can be biodiversity loss within their operations and supply applied, the mobile industry is poised to make chains will be crucial in shaping the trajectory and substantial and meaningful progress in protecting the world's natural resources.

Case study

Strengthening sustainable palm oil through mobile blockchain technology

GSMA grantee, J-Palm, has achieved notable success in the palm kernel oil (PKO) industry in Liberia through their innovative use of technology. During the grant period, they became the first African producer to earn both organic and Regenified certifications, positioning them as a global leader in regenerative agriculturecertified PKO. According to endline research, 100% of farmers stated that their income increased or stabilised during the project.

A key factor in their success was the development of traceability and tree health apps. The traceability app has been instrumental in documenting the origin of palm kernels and ensuring sustainable harvesting practices, enabling J-Palm to meet export requirements and successfully enter the U.S. market, surpassing initial revenue projections.



J-Palm's integration of mini-mills across 96 communities enhanced their operational efficiency and strengthened local sourcing, allowing them to produce competitively priced PKO while fostering community ties. This strategic approach has laid the groundwork for financial stability and future growth.

By focussing on PKO, which delivers higher profit margins than palm oil, J-Palm has not only achieved impressive financial results, but also emerged as a leader in sustainable business practices. Their emphasis on traceability has allowed them to write a new narrative for palm oil - one that champions environmental responsibility alongside business success.

success of nature tech.







Digitalising natural resource management in the Amazon

In 2024, the GSMA ClimateTech programme partnered with IDB Invest to explore how digital solutions can transform sustainable natural resource management across Latin America and the Caribbean. This joint study delves into how mobile and digital technologies can enhance efforts to protect the unique biodiversity of the Amazon, bolster climate resilience and empower local communities. By showcasing innovative, tech-driven approaches, the report highlights how these solutions can optimise the sustainable use of natural resources, promote resilient livelihoods and secure the Amazon's ecological future.

Read the full report: *Exploring the Case for Digitalizing* Natural Resource Management in the Amazon

What's next?

Spotlight

The mobile industry's action for nature

Businesses have both a responsibility and an economic incentive to tackle the ever-growing nature crisis. With a host of naturerelated reporting requirements taking effect in 2024, biodiversity has soared up the private sector agenda.

To understand the status of biodiversity in the mobile industry, the GSMA ClimateTech programme analysed the sustainability portfolios of 25 of the largest MNOs with substantial operations across Africa and Asia, and consulted with seven leading MNOs in the nature tech space. Our research found that:

- Biodiversity is gaining traction in the mobile industry. Many MNOs have begun to grapple with new biodiversity reporting requirements and are conducting materiality assessments to understand the significance of their biodiversity risks and opportunities. Although the topic is receiving more attention, it is still a lower priority than climate and net-zero commitments in terms of budget allocations.
- Biodiversity initiatives are shifting from philanthropy to a core business strategy in the mobile industry. So far, most biodiversity projects undertaken by MNOs have fallen under corporate social responsibility (CSR) or sustainability functions. However, there has been a gradual shift to the triple bottom-line principle of People, Planet and Profit, with MNOs aligning biodiversity initiatives with their business strategies to future-proof operations.

Several MNOs are already active in biodiversity-related activities. For example, <u>Safaricom</u> has partnered with the Kenya Forest Service to plant 5 million trees by 2030, while Airtel Africa is using data technology to help monitor and protect rhinos. Elsewhere, MNOs such as Huawei and Orange are leveraging their technologies to support governments and academic institutions in monitoring and managing biodiversity hotspots. They are also using tech to increase customer education and engagement. For example, in the Philippines, Globe offers tree planting as a reward for customers using their mobile money service. Three key initiatives are presented below, ranging from the use of IoT to protect mangroves in Indonesia, to the use of AI to tackle human-wildlife conflict in Kenya.

MNOs innovating for nature



Indosat Ooredoo Hutchison's (IOH) innovative project is digitalising mangrove conservation in North Kalimantan, Indonesia.

IOH provides IoT sensors to farmers to promote more sustainable shrimp farming practices. These sensors allow farmers to collect data on water quality to improve pond productivity.



Huawei's Tech4Nature initiative, launched in 2020 in collaboration with the International Union for Conservation of Nature (IUCN).

The Tech4Nature programme uses digital technology to promote the effective conservation and management of more than 300 protected areas worldwide on the IUCN Green List.

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GSMA Biodiversity Project Group | As part of the industry's commitment to nature, a group of more than 40 global MNOs has been established to understand and analyse what biodiversity means for the mobile industry and what risks and opportunities should be considered when investigating impacts on nature.

In January 2025, the **GSMA Nature Guidance for the Mobile Industry** was established. This guidance tackles both the why and the how of nature assessments for the mobile industry, providing a phased, actionable approach to initiating and integrating a corporate nature strategy. It provides prescriptive steps aligned with international frameworks, such as TNFD, CSRD and SBTN, accommodating MNOs at all levels of experience and ambition.

Vodafone's Al-driven m-Twiga solution is designed to tackle humanwildlife conflict.

The project is a collaboration between SMS to alert nearby communities. technology and conservation experts in Vodafone, Safaricom and WWF.





The project is an interesting example of how nature-tech initiatives can address the triple bottom line - in this case, by safeguarding mangroves, improving farmers' livelihoods and aligning with overall business needs.

This has included leveraging a range of technologies from Huawei and their partners, from acoustics and visual data to wired and wireless connections, cloud and AI services.

These technologies have helped to improve the management, monitoring and assessment of protected areas and to track progress using unique benchmarking tools.

Using infrared cameras and AI software, the m-Twiga system is being developed to detect and identify various predator species and send an

While m-Twiga is still in the proofof-concept stage, it presents a compelling case for the involvement of MNOs in solving pressing conservation issues.

8. **Blue economy**

Our oceans, seas and coasts are the lifeblood of our planet and the essence of our "blue economy". A recent estimate suggests that the annual economic value of ocean ecosystems could be around \$2.5 trillion, roughly equivalent to the world's seventh-largest economy.⁴⁴ The OECD projects this could top \$3 trillion by 2030 and employ more than 40 million people.⁴⁵

Investment in the blue economy - including improved fisheries management, sustainable aquaculture and habitat protection - could help restore ocean productivity, creating benefits for communities in LMICs. Investing in natural assets like coral reefs and mangroves not only supports local economic activities, such as tourism, but also enhances ecosystem services. At the same time, investing in innovations in renewable energy and biotechnology can contribute significantly to the fight against climate change.46

Despite the economic and ecological benefits, the blue economy generates a range of negative environmental impacts such as carbon emissions, pollution, habitat destruction, waste generation, plastic pollution and water contamination.47 Emissions from the fishing and aquaculture sectors alone are estimated to contribute 1.35% to 2% of global CO2 emissions.48

Recognising this delicate balance, there is growing focus on creating a sustainable blue economy - one that can tackle the fragmented approach to managing our ocean, coastal and freshwater ecosystems while meeting the planet's economic, social and ecological needs.

44. UNEP. (2023). Sustainable Blue Economy.

- 45. OECD. (2024). The Blue Economy in Cities and Regions.
- 46. OECD. (2024). The Blue Economy in Cities and Regions.
- 47. OECD. (2024). The Blue Economy in Cities and Regions.
- 48. UNCTAD. (2023). Decarbonization opportunities and challenges in the Blue Economy
- 49. World Bank. (n.d.). "Blue Economy"
- 50. IUCN. (2024). Towards a Regenerative Blue Economy.

The annual economic value of ocean ecosystems is estimated to be approximately

\$2.5 trillion

Although there is not a single, universal definition of the **blue economy** – and it is often used interchangeably with "ocean economy" - the World Bank defines it as the sustainable use of the ocean "for economic growth, improved livelihoods and job creation, while preserving the health of ocean ecosystems".⁴⁹



What is the blue economy?

More recently, focus has shifted to "regenerative" or "sustainable" blue economy models that balance economic development with the sustainable use and conservation of marine resources.⁵⁰ This approach aims to protect biodiversity and ecosystems while addressing climate change and promoting social equity.

Innovating for the blue economy

The emergence of blue technologies in recent years is helping to strengthen the monitoring and preservation of marine ecosystems. These mobile and digital-enabled solutions have the potential to transform the blue economy by improving the management of maritime resources, mitigating risks and scaling impact.

We've already seen investment in blue economy technologies accelerate across Asia, Africa and Small Island Developing States (SIDS), thanks to their potential for sustainable growth. The Asian Development Bank has allocated \$5 billion to support sustainable ocean activities in the region, including renewable energy and aquaculture, while also launching initiatives like the Blue Finance Accelerator in Indonesia to back startups.⁵¹

In Africa, the marine biotechnology market was forecast to grow by \$2.5 billion from 2020 to 2024, with countries like Mauritius, Seychelles and Kenya increasing investment in marine biotechnology, renewable energy and sustainable fisheries.⁵²

For SIDS, blue economy investments are vital for climate adaptation and economic growth. Initiatives like the UN's SAMOA Pathway and innovative tools like blue bonds are promoting private investment in marine resources, as demonstrated by an

\$800,000 grant to the Seychelles to develop its marine biotech sector.53

Recent GSMA research mapped the role of mobile and digital innovations in strengthening the blue economy in LMICs. It explored trends in technologies, use cases and their socio-economic impacts, as well as the partnerships and investment streams underpinning them. The following heat map shows the 150+ blue tech projects we analysed.

Driving blue innovation through grants and partnerships

The GSMA has been actively exploring blue tech solutions across Africa and Asia through the GSMA Innovation Fund for Climate Resilience and Adaptation. Grant funding has supported startups to strengthen value chains and food security in fisheries, and to work with coastal communities in Indonesia through our partnership with MNO Indosat Ooredoo Hutchison.

These projects highlight both the opportunities of technology to support fishers - such as the use of IoT sensors in Kenya - and the challenges of developing solutions for national assets in Tanzania. This is illustrated by the experience of Simusolar, an Innovation Fund grantee.

Meet the GSMA blue tech startups

Strengthening



Aquarech, Kenya

Improving fish farmers' productivity, enabling market access and creating an inclusive aquaculture value chain through mobile technology and IoT sensors.

GSMA



HydroNeo, Thailand

Supporting fishers' climate resilience livelihoods, adapting to and shrimp farm weather changes and sustainable fisheries performance for management in Lake better livelihoods in Victoria, Tanzania, rural communities through IoT-enabled through IoT and productivity and mobile solutions. activity-tracking equipment.

💲 Simusolar



Simusolar, Tanzania InQube, India

Enhancing smallholder farmers' incomes through farm decision support, supply chain enablement and regenerative farm practices through a service technology (SaaS) platform. The InQube platform will contribute to a carbon offset financing project for mangrove reforestation with digital tracking, enhancing financial support for farmers by 2027.



52. Wetaya, R. (8 February 2022). "Blue economy seen as catalyst for Africa's economic resurgence". Alliance for Science.

53. World Investment Forum. (16 October 2023). Video: "Promoting investment in the blue economy"



The GS Heatma Digital blue ec	MA Blue Tech ap: innovations for the conomy in LMICs	No. of examples	Mobile app	Digital platform and/or marketplace	Location data, GIS & spatial mapping	Al / Machine Learning	Blockchain / digital ledgers	Sensors / IoT / M2M RFID tags	Satellite, remote sensing and LiDAR	AR/ VR	Drones and robotics	New computing technologies	Nanotechnology	Mobile money	Hardware	Software	Public / donor DFI funding	NGO funding	Accelerator / bootcamp	Private finance (VC, etc.)	Private foundations	Corporate and individual funders (incl. MNOs)	Social
BLUE ECONOMY SECTOR	DIGITAL INNOVATION USE CASES					I	DIGITAL	TECHN	OLOGIE	S USED					SOLU	τιον		SOL	IRCES C	FFINAN	ICE		CON RES
Blue carbon, ecosystem services and resilience 28 EXAMPLES	Marine and coastal ecosystem protection and restoration Environmental data collection and analysis Real-time data to support decision-making Anti-poaching activities for marine wildlife	6 14 3 1																					
Coastal tourism 10 EXAMPLES	Public awareness raising of environmental issues 3D printing/robotics/automation for ecosystem restoration Resilient and safe tourism Ecosystem services payments from tourism	1 3 4 1																					
Fisheries and	Sustainable tourism information and incentives Virtual reality (VR) tourism Index-based insurance for coastal tourism Sustainable and traceable supply chains	3 1 1 10																					
aquaculture 74 EXAMPLES	Management of wild fish stocks, including vessel tracking Access to aquaculture knowledge and supplies Access to finance for aquaculture Enhancing health and productivity of fish farms	8 5 9 20																					
	Data analytics to enhance resilience of fisheries Enabling access to markets for produce Access to cold storage Optimisation of production and harvesting processes	1 13 4 2																					
Innovative industries 4 EXAMPLES Maritime security /	Disaster Early Warning Systems (EWS) for fishing communities Business support to blue economy entrepreneurs Centralised repository for marine researchers and contractors Monitoring vessel movements	2 1 3 1																					
situational awareness 5 EXAMPLES Renewable energy	 ^S Combating illegal activities, including illegal fishing Crowdsourcing real-time data on maritime threats/issues Coastal or island community microgrids Remote inspection and resilience for power systems 	2 2 2 1																					
3 EXAMPLES	Data collection and analysis for renewables Community access to electricity Smart fleet and freight management services	0 0 4																					
and ports 14 EXAMPLES	Smart ports operations Smart inspection/maintenance of vessels and infrastructure CO2 emissions tracking Maritime safety training	2 6 1 1																					
Waste and plastics 13 EXAMPLES	Secure and traceable supply chains Identification and cleaning of pollution sources/hotspots Plastic waste marketplace (including traceability)	0 1 10																					
Water 5 EXAMPLES	Public awareness raising Water quality monitoring Water resources management	1 1 1 2																					
	Improved efficiency of desalination Remote inspection and maintenance of infrastructure	2																					

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UN	ITY CE	EXAMPLES	
		GSMA support for mangrove conservati	
		BlueFISH, Marine InVEST Analysis Tool,	ReefCloud
		Digital Earth Africa, Vasar Labs, AQUAN	1 project
		Data-based decision making for turtle h	atchery
		Moana Pasifika	
		Galapagos Islands, The Blue-Bot Projec	t, Coral, etc.
_		Nadis, SatSense Solutions, mobile big d	ata
		Ocean Eye	
		Sebumi, Carboni Bank, Ol'au Palau, Blue	SEAL
		DigiFish	
		Parametric insurance for surfing tourisn	n hotspots
		BlueTRACE, Remora, TraSeable Solution	ns, Ambrotech
		DigiFish, ShellCatch, FishFace, Perahu Ap	p, mFish
		Jala, Venambak, RioFish	
		Aqua Connect (AquaCred), Jala, Alune,	FishLog
		Ecosea, Innovasea, Aqua Connect, Amb	rotech, Eruvaka
		Fish Face Project (Indonesia)	
		Aqua Connect, Fresh-to-Home, Jala, eF	ishery, Aruna
		FishLog, Venambak, KeepITCool, Kuza I	Freezer
		Altum Lab/ Al Bruna, Mari Oceans	
		Elrha / Airtel Early Warning System for F	Fishermen
		Maritimepreneur	
		Participatory vulnerability assessments	, SHORE Institute
		Sea-vision System and Mercury System	
		Ocean Futures, Ocean Mind	
		CoralApp, Reef Check Malaysia	
		SunAsia Energy, Sunseap Group	
		Hitachi's TXpert™ to remotely monitor r	enewable energy
		Aventra Group, Smartseas AI, e-Port Pte	9
		Aventra Group, N-Bunker	
		BeeX, Groundup.ai, Planys, EyeRov	
		Portcast	
		CEMS	
		Ichthion	
		Banyan Nation, Plastics for Change, Rec	ykal, Rekosistem
		Ayiti Blue Ocean Plastics Solution	
		Gringgo	
		ORBTY	
		Bariflo Labs, SkyEye	
		Remote Waters, Bloom Alert	

Spotlight

Explore our Blue Tech Heatmap

As a growing area of interest, the GSMA ClimateTech programme aims to develop long-term strategies to strengthen the blue economy through research, advocacy and partnerships. In 2024, we conducted a study examining the role of mobile and digital innovations in advancing the blue economy across LMICs. This research identified key trends, best practices and high-impact innovations, with a particular focus on applications for vulnerable communities.

At the core of this study is the **Blue Tech Heatmap** (shown on the previous page), which analysed 156 digital innovations across Southeast Asia, Latin America, the Caribbean, Small Island Developing States (SIDS) and East Africa. The heatmap provides a data-driven snapshot of emerging opportunities across blue economy sectors.

What did we learn?

While digital innovation in the blue economy is accelerating, adoption remains uneven across sectors and regions. Key insights include:

- Fisheries and aquaculture dominate digital adoption, accounting for 74 of 156 innovations. Solutions focus on traceability, monitoring and resource management designed to drive economic and environmental gains.
- Blue carbon and ecosystem resilience are rising priorities, particularly in the Caribbean and SIDS, where climate adaptation is critical.
- Southeast Asia leads in blue tech innovation, with Indonesia emerging as a key hub. Nearly half of all mapped innovations in the region come from Indonesia, driven by high demand, a strong enabling environment and a thriving startup ecosystem.
- India is South Asia's digital leader, with innovations spread across key blue economy sectors.
- Kenya is East Africa's focal point, where digital solutions primarily target fisheries and aquaculture.
- SIDS rely on regional collaboration, using crosscountry digital strategies to address market size constraints. Barbados leads in the Caribbean, despite regional barriers like high costs and limited digital infrastructure.

Barriers to digital adoption in the blue economy

Despite strong momentum, the research also highlighted barriers limiting the scale and impact of digital solutions:

- Low awareness: Many wider blue economy stakeholders remain unfamiliar with the benefits of digital tools, slowing uptake.
- Investment hesitancy: Despite growing funding being directed to the sector, unproven commercial models deter investors in emerging markets.
- Regulatory gaps: Many blue economy regulations do not yet recognise or promote digital solutions, creating uncertainty for innovators and investors.
- Connectivity and digital literacy constraints: Limited infrastructure and technical expertise, particularly in remote coastal communities and SIDS, restrict the effective deployment of digital solutions.

Looking ahead

The research highlighted both the potential and challenges of digital innovation in the blue economy. Unlocking scale requires coordinated efforts from MNOs, startups, policymakers and development partners. By addressing adoption barriers and driving targeted investment, digital technologies can power sustainable, inclusive growth in LMICs.

Find out more about our work on the Blue Economy <u>here</u>.

Case study

Innovating Against the Odds: Deploying IoT fishing lights in Lake Victoria

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sene lamps did.

Fisherman

Simusolar, with funding from the GSMA, introduced an IoT fishing light called "Nuru" to enhance sustainable fishing practices in Lake Victoria, Tanzania. Nuru is an energy-efficient, trackable and remotely controlled light that integrates with a mobile app to manage fishing operations, monitor weather and track usage. This solution was designed to support the Ministry of Fisheries in digitalising fishing activity by providing anonymised data.

The project encountered regulatory challenges that affected its progress. Initially, Simusolar aligned with the government policies, but subsequent changes introduced additional testing requirements and restrictions, leading to delays. Both the sale price of the fishing light compared to other competitors affected, alongside the ban on fishing lights affected market reach.

Despite these setbacks, Nuru proved its value. Once on the market, the lights were quickly acquired by more than 1,000 fishers. GSMA research found that 100% of Nuru users saw improved lake conservation, with 82% reporting overall economic gains. The switch from lead acid batteries to solar technology also cut carbon emissions by 36 metric tonnes and reduced lake pollution by 240 batteries. A fish catch comparison demonstrated that the use of Simusolar's fishing lights resulted in a 15% higher catch

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than competitors, leading to high demand for their solution.

Simusolar's experience highlights the challenges of navigating local regulatory and political dynamics when deploying disruptive technologies. Moving forward, Simusolar plans to refine their strategies to better align with regulatory frameworks and expand their market presence, continuing to support sustainable fishing and enhance rural incomes in Kenya and beyond.

I have achieved great economic success since using Nuru lights. I also appreciate that Nuru Solar lights do not harm the fishermen as kero-

"

What's next?

While tech solutions offer great promise, a sustainable and thriving blue economy requires significant policy reforms. Regulatory frameworks in LMICs often fall short, struggling to keep pace with rapid technological change. This regulatory lag, or pacing problem, is particularly severe in SIDS where outdated policies and slow policy cycles hinder the growth of digital industries. Fragmented and overlapping national regulations further complicate efforts to coordinate and implement effective policies.

As a key future sector of interest for the GSMA, we are committed to exploring these challenges long term through research, advocacy and partnerships. In the short term, our focus remains on supporting innovative startups through the GSMA Innovation Fund 2.0, providing the funding and technical assistance needed to invigorate the blue economy and ensure sustainable growth.



Is AI helping or hurting the climate crisis? 3

9. Al for climate action

Over the past year, AI has been hailed as a gamechanger for climate action – but is it really the solution we've been searching for? AI offers significant promise, particularly in LMICs where innovative approaches are urgently needed to bridge inequalities and enhance climate resilience. By strengthening decision-making and supporting the development of new infrastructure, AI is ushering in a new era of possibilities.

The tech industry is increasingly channelling investments into AI-powered climate solutions, with major players such as <u>Bezos Earth Fund</u>, <u>Mercy Corps</u> <u>Ventures</u> and <u>Google</u> leading the way. Meanwhile, global bodies like the <u>UNFCCC</u> are exploring how AI can accelerate progress on climate goals. Yet, there is a risk of overreliance on AI to address the climate crisis. The technology that promises to help reduce emissions is, paradoxically, contributing to rising emissions.

Google reported a <u>13% increase in greenhouse gas</u> <u>emissions in 2023</u>, driven largely by the high energy demands of AI systems and the limited availability of renewable energy in parts of Asia and the U.S. <u>Microsoft also saw their emissions surge by 29% since</u> <u>2020</u> despite an ambitious pledge to become carbon negative. These examples highlight a critical dilemma: is AI exacerbating the problem we're trying to solve?



Al for Impact

The GSMA <u>AI for Impact</u> initiative, led by a taskforce of **27 MNOs** and an advisory panel of **12 UN agencies**, fosters global collaboration to **promote action** and tangible **outcomes**.

This initiative outlines the technical, commercial and ecosystem requirements to create **effective data-driven products** and services while ensuring adherence to privacy and ethical standards. By supporting national-level deployments, the GSMA replicates **successful models** and spearheads market-shaping campaigns to stimulate demand and overcome obstacles. The benefits of AI remain far from universally accessible. With more than 3 billion people still offline, many are excluded from participating in or benefiting from the AI revolution.⁵⁴ We know that startups in LMICs often face pressure to align with frontier tech trends to gain visibility, yet many simply adopt buzzwords without genuinely integrating AI in their solutions focus on techdriven fixes can shift attention away from practical, intuitive solutions that vulnerable communities urgently need. In many cases, low-tech approaches are more sustainable and accessible in LMICs, particularly because they do not rely on connectivity or complex systems that can break down during power outages or network disruptions.⁵⁵

At this stage, most LMICs are not yet equipped to leverage AI at scale. According to the International Monetary Fund's latest AI Preparedness Index - which assesses digital infrastructure, human capital and regulatory environments - many countries face significant barriers. Limited internet penetration, unreliable power supplies and inadequate data infrastructure mean that even the most promising AI applications struggle to gain a foothold. A shortage of skilled AI professionals and underdeveloped regulatory frameworks further inhibit countries from adopting and scaling AI solutions. Without significant investment in digital capacity building, there is a risk that LMICs will be left behind in the AI revolution, deepening existing inequalities and missing critical opportunities for climate action and sustainable development.

With these challenges in mind, it's crucial to critically evaluate where AI can have the most impact and where we might risk overestimating its capabilities. The latest research from the GSMA, combined with insights from Innovation Fund grantees, explore these tensions and shed light on both the potential and limitations of AI for climate action. In the following case studies, we explore real-world applications, uncovering where AI could have the greatest impact.

 SSMA. (2024). The State of Mobile Internet Connectivity Report 2024.
 SSMA. (2023). Exploring barriers and incentives to digital solutions in Mean Control Content of Content

- Natural Resource Management.
- Al4D Africa. (2024). <u>Al in Africa: The state and needs of the ecosystem</u>.
 Humeau, E. (4 September 2024). "<u>What is holding back Generative Al in Africa?</u>" GSMA Mobile for Development Blog.
- 58. AI4D Africa. (2024). AI in Africa: The state and needs of the ecosystem.



The transformative potential of AI in Africa

Al holds immense potential to transform Africa's socio-economic landscape, with projections suggesting it could boost the continent's economy by a staggering \$2.9 trillion by 2030.⁵⁶ This increase – equivalent to a 3% rise in annual GDP – has the capacity to translate into significant development gains, advancing progress on the Sustainable Development Goals (SDGs). However, while Al technologies are already being deployed across Africa, there is a crucial need to focus these solutions on the continent's unique socio-economic and environmental challenges.

A flagship 2024 GSMA report, <u>AI for Africa: Use cases</u> <u>delivering impact</u>, addresses this gap by exploring AI-enabled innovations in Kenya, Nigeria and South Africa - three of Africa's leading tech hubs. The research analyses more than 90 AI use cases across critical areas like agriculture, food security, energy and climate action.

Al Adoption: Predictive vs generative Al

Predictive AI is already driving progress in agriculture by improving crop health forecasting and enabling credit assessments. In the energy sector, it plays a key role in optimising grid management and planning. In contrast, generative AI is still in its infancy, held back by a lack of high-quality, locally relevant data and the significant computational resources required.⁵⁷

A critical barrier to the adoption of generative AI is the scarcity of language data. Currently, only 0.02% of global internet content is available in African languages, compared to 53% in English.⁵⁸ This stark discrepancy limits the development of large language models tailored to the diverse linguistic and cultural contexts of Africa. However, the growing availability of geospatial data, such as satellite imagery, is accelerating AI-driven innovations in agriculture and energy, underlining that data accessibility remains a double-edged sword.

The path forward

The report underscores the importance of local leadership in driving AI adoption. Despite significant barriers, local organisations are spearheading AI initiatives, often using open data sources and collaborating with tech startups. However, their ability to scale these solutions depends heavily on access to financing, partnerships and resources like high-quality data and computing power.

To truly realise the transformative potential of AI in Africa, it is essential to bridge data gaps, support local innovators and harness the continent's mobile-first advantage. With the right investments and collaborations, AI could play a pivotal role in addressing Africa's development challenges – turning ambitious economic projections into tangible reality.

For a comprehensive analysis of AI ecosystems and specific use cases, explore the full report, <u>AI for Africa: Use cases delivering impact</u>, alongside country-specific insights from <u>Kenya, Nigeria</u> and <u>South Africa</u>.



Predictive AI uses data patterns to forecast future outcomes or trends, such as predicting crop yields or energy needs.

Generative AI creates new content or data like text, images or even synthetic speech, based on learned patterns from existing data.

One of the report's key findings is that the vast majority (97%) of current Al applications in Africa rely on predictive models while only 3% use generative Al.

The GSMA Innovation Fund: AI-backed solutions

The following case studies feature three Innovation Fund grantees that are using AI to deliver impactful climate solutions, showcasing the real-world applications of AI solutions.

Case study

Harnessing predictive AI for farm equipment-sharing in Nigeria

Hello Tractor is a digital platform that connects tractor owners with farmers through a farm equipmentsharing app and GPS fleet management system. The solution helps farming communities improve planning and preparedness in the face of unpredictable rainfall patterns. The startup received a grant from the GSMA Innovation Fund to enhance tractor services, optimise harvesting and yields and build a more resilient network of farmers and tractor owners.

Collaborating with predictive AI firm Atlas AI, Hello Tractor developed a demand-forecasting model to optimise tractor availability in Nigeria and Kenya. Using machine learning, the model identifies key factors driving demand for tractor services. By analysing data on weather patterns, crop types, agricultural activities and socio-economic factors, it predicts where demand will peak throughout the year. This allows Hello Tractor to proactively recruit tractor owners in areas where shortages are expected and



strategically expand their network of mechanisation hubs. These hubs serve as one-stop shops for machinery, maintenance, agricultural inputs and market linkages. Additionally, proprietary and thirdparty data from Atlas AI, such as socio-economic and crop information, have been crucial in determining the optimal locations for these innovation hubs.

Currently, Hello Tractor operates in 16 African countries with a fleet of more than 4,500 tractors and combines, serving more than a million farmers across 2.9 million acres. This network is supported by more than 2,500 booking agents. Scaling up the use of AI could boost Hello Tractor's ability to optimise resources, improve service delivery and enhance agricultural productivity and food security across Africa.

Learn more: AI for Africa: Use cases delivering impact -Nigeria deep dive

Crop2Cash: The AI for impact ecosystem illustration



Illustration adopted from GSMA AI for Impact, 2023

Case study

Pioneering an AI-powered national hotline for agriculture in Nigeria

GSMA grantee Crop2Cash is a Nigeria-based agritech dedicated to making formal financing accessible to smallholder farmers. It supports farmers facing drought conditions in Nigeria by helping them manage financial risks, improve access to markets and inputs through a digital marketplace and adapt their farming practices with climate-smart advisory services via USSD. Crop2Cash has served more than 500,000 farmers across 13 states in Nigeria and has reached more than 700 local government areas. Farmers have reported up to a 70% increase in income and a 35% increase in yields thanks to the use of climate-smart inputs.



In July 2024, Crop2Cash launched a national hotline for agriculture called FarmAdvice. This AI-powered IVR system uses generative AI technology to democratise access to agricultural knowledge and extension services. Smallholder farmers can dial a toll-free number on any device, 24/7, to interact with their own extension agent and receive real-time, personalised agricultural advice in their local language (English, Yoruba or Hausa).

To develop the hotline, Crop2Cash fine-tuned large language models to build an extensive knowledge base on agriculture and tailored the information to Nigerian farmers, incorporating local weather and remote-sensing data. Partnerships with domain experts, including government bodies, NGOs and leading agricultural institutions, ensure that the AI system stays up-to-date with the latest innovations and best practices in the sector.

Crop2Cash is also working to integrate real-time IVR advisory solution is a promising step towards market price information and build predictive models sustainable agriculture in Nigeria. to forecast price trends for different crops based on usage data. This will give farmers insights into what to Learn more: AI for Africa: Use cases delivering impact plant and when to sell to maximise their income and Nigeria deep dive improve their livelihoods.







Al is a key priority for the Nigerian government as it aims to position the country as a global leader in the development and regulation of the technology. In August 2024, the government released a draft national AI strategy that outlines a roadmap for harnessing the technology to enhance social and economic welfare and guality of life. Agriculture is one of the critical sectors highlighted in the strategy, suggesting that Crop2Cash may be well positioned to contribute to the national agenda. Their Al-powered

Case study

Leveraging AI to strengthen early warning systems in the Philippines

Globally, AI is transforming disaster risk reduction (DRR) by enhancing weather predictions, hazard mapping, real-time detection, early warnings and damage assessments. In the Philippines – home to more than 7,000 islands and the world's most disaster-prone country, experiencing an average of 20 tropical storms annually – AI-enabled DRR has become a critical tool.

Komunidad, a Philippines-based startup, helps governments, corporations and communities respond more effectively to natural hazards with meteorological data analytics and early warning systems (EWS). With support from the GSMA Innovation Fund, Komunidad worked with local authorities on Siargao Island to enhance disaster preparedness and response, particularly in the aftermath of Typhoon Rai (Odette) in 2021.

Alongside the grant, in April 2024, Komunidad launched Curbeet, an Alpowered platform designed to serve as a comprehensive early warning hub. Curbeet goes beyond weather alerts by offering location tracking for friends and family in high-risk areas, an Al-driven safety chatbot and rapid access to emergency services. In the Philippines, where there is no centralised emergency number, Curbeet helps users quickly find the correct local contact using Al-verified databases.

Curbeet also bridges the digital divide by sending SMS alerts to feature phone users, ensuring broader coverage. Community leaders can upload phone numbers and locations of farmers, enabling quick, cost-effective alerts to remote, at-risk populations without smartphones.





Although Komunidad was not initially Al-driven, integrating Al has enhanced its platform, adding valuable features, expanding customer reach and supporting rapid scaling. By carefully analysing where Al could add value, Komunidad developed a DRR system that is inclusive, robust and user-focussed. This helped them to unlock an additional \$500,000 in investment during the GSMA grant period, further fuelling their growth. Komunidad's innovative approach sets a new standard for disaster preparedness – one that it seeks to scale to other countries.

Learn more about how Komunidad has integrated AI here.

Read the full case study here.

Spotlight

Al for Climate Action in Asia Pacific: What role can MNOs play?

In October 2024, the GSMA hosted a <u>roundtable</u> on Al innovation for climate action at <u>Mobile 360 Asia Pacific</u> (<u>M360 APAC</u>), our flagship event for the mobile industry in the region. The roundtable brought together a diverse group of participants, including startups, MNOs, donors and international development organisations, to explore the role of Al in addressing climate challenges in the Asia-Pacific region.

Al for climate action in Asia Pacific

Predictive and generative AI tools are increasingly being integrated in climate-tech solutions, with the potential to optimise and accelerate climate initiatives. They are particularly relevant in the Asia-Pacific region, home to some of the world's most climate-vulnerable nations. While Small Island Developing States face rising sea levels and extreme weather, lower-middle-income countries like Bangladesh and India and high-income nations like Japan and South Korea are experiencing more frequent heatwaves and severe flooding. The region also boasts some of the most dynamic AI ecosystems globally, with a higher concentration of AI-driven climate-tech startups compared to Africa.

MNO partnerships in climate solutions

For MNOs, AI has traditionally been a tool for business optimisation – enhancing fraud detection, customer service (e.g. AI chatbots), network management and reducing energy waste. However, they also have a crucial role in fostering technology-driven partnerships. By leveraging their extensive customer networks and data capabilities, MNOs can help scale climate innovations.











In the latest round of applications to the GSMA Innovation Fund for Climate Resilience and Adaptation

of startup pitches from Asia

included the use of AI compared to

26% of pitches from Africa

During the M360 roundtable, <u>Globe</u> <u>Telecom</u> from the Philippines showcased their work on climate-related AI use cases, such as disaster response, business continuity planning and air pollution monitoring. In collaboration with local startup <u>uHoo</u>, Globe developed an AIpowered system that not only improves air quality in workplaces by managing ventilation, but also reduces energy consumption.

Similarly, Indonesian MNO <u>XL Axiata</u> has teamed up with local tech firms, like AI startup Nodeflux, to provide Jakarta's city government with an AI-enabled, IoT-based flood monitoring system. This solution uses sensors to track water levels, rainfall, flow and pump activity, enabling data-driven decisions about flood management.

While the AI landscape varies significantly across Asia Pacific, with differing levels of readiness among low-, middle- and highincome countries, this roundtable of experts underscored the importance of sustaining both public-private and private-private partnerships, which are key to scaling AIdriven climate solutions across the region.

Read the full blog: <u>AI innovations driving</u> <u>climate action in APAC: Insights from M360</u>

What's next?

Across the Innovation Fund portfolio, we've seen that AI's greatest strength is amplifying existing climate solutions rather than trying to reinvent them. When AI is integrated in existing systems, it can supercharge digital agriculture, refine market advisory and support data-driven decision-making. It also has the potential to be more inclusive, particularly through language options that reach communities often left behind. However, to harness the capabilities of AI, we need context-specific data in local languages and tailored to specific areas, such as agriculture, food systems and weather. Machine learning-based predictive AI solutions, especially generative AI innovations, depend on access to this diverse and accurate data. Without it, these technologies risk perpetuating gaps, limiting their transformative potential and leaving marginalised communities further behind.

We know that technology alone is not enough. The potential of AI can only be unlocked if it is supported by strong infrastructure and targeted investments in skills development. Many regions across LMICs still face significant barriers, from limited internet access to gaps in AI expertise. That's why fostering collaboration between MNOs, tech innovators, local governments and NGOs is crucial to ensure AI solutions are not only impactful, but also sustainable.

Above all, we must be discerning. Rather than pushing for high-tech fixes, we need to give equal weight to practical, energy-efficient applications that have real-life benefits. Open-source tools and transparent knowledge sharing will be key to scaling the positive impacts of Al. Although it's a powerful tool, its true impact will hinge on how we deploy it – in solutions that are sustainable and truly meet the needs of the most vulnerable communities.



The GSMA Innovation Fund for Impactful AI

Launched in January 2025, the GSMA <u>Innovation Fund for Impactful AI</u> will provide grants and venture-building support to small and growing enterprises that leverage AI and other emerging technologies, in conjunction with mobile technology, to positively impact the lives of people in LMICs. The Fund seeks solutions that demonstrate the transformative potential of innovative AI and supporting technologies – such as computer vision, IoT, remote sensing, drones and blockchain⁵⁹

- to address socio-economic and climate-related challenges.

59. The Fund is interested in blockchain applications such as decentralised AI model training and sharing, data transparency, data interoperability and integrity.







Unlocking climate finance with innovative mechanisms

The COPs highlighted the crucial role of private capital in closing the finance gap. While public funding remains important, it is increasingly clear that it will not be enough. Venture capital, green bonds, blended finance models and carbon and biodiversity markets were all hot topics. Yet, the real challenge lies in de-risking investments to attract private capital to LMICs, where the need is greatest but perceived risks are higher.

A key focus for the GSMA has been addressing these barriers head on. We know that innovators are crucial in driving locally relevant solutions, yet they often struggle to access the funding needed as traditional financial institutions remain hesitant to back unproven technologies or new players in emerging markets.

This is where digital tools - from blockchain to digital monitoring, reporting and verification (dMRV) systems - are poised to have a transformative impact by enhancing transparency, cutting costs and building investor confidence.

Challenges to innovative financing mechanisms

- **Complexity:** Many innovative financing mechanisms involve intricate structures, making them difficult to design, implement and monitor effectively.
- **Regulatory hurdles:** Alternative financing often comes with new or complex regulatory frameworks, involving non-bank lending requirements, antimoney laundering provisions and data privacy.
- **Risk management:** Many innovative financing models are still in their early stages, and therefore may seem to present higher levels of risk than traditional financing.
- Stakeholder alignment: Bringing together various investors with divergent interests and perspectives can present challenges, as some of their objectives may misalign.
- Data and metrics: Measuring the impact and success of innovative financing mechanisms can prove cumbersome and resource intensive.
- Long-term commitment: Innovative financing models are designed for longer-term goals, requiring more patient capital with a sustained commitment from stakeholders.

The role of digital technologies in enabling innovative financing mechanisms

- Improved efficiency and transparency: Digital platforms streamline processes by reducing administrative burdens and improving transparency. Blockchain technology, for example, can provide secure and transparent ledgers to track transactions.
- Data analytics: Digital technologies allow for the collection, analysis and interpretation of vast amounts of data. Together with advanced analytics and AI, these insights can lead to better decision-making, optimised resource allocation and reduced risk in lending.
- Partnerships and collaboration: Digital platforms facilitate collaboration between different stakeholders, enabling governments, private sector entities, NGOs and individuals to work together more effectively in supporting innovative financing mechanisms.
- Real-time monitoring and reporting: Digital systems that allow for real-time monitoring and reporting of progress and outcomes create a feedback loop that helps stakeholders to make timely adjustments and mitigate risk by tracking objectives and goals.

Our work with GSMA Innovation Fund grantees is specifically designed to de-risk investments and help unlock critical finance for early-stage climate innovators across Africa and Asia, empowering them to scale their impact and support communities most in need.

We've seen that the rise of mobile connectivity and digital adoption across LMICs is enabling digital technologies to tap into the potential of innovative financing mechanisms in these regions.

The GSMA's flagship Digitally Enabled Climate Finance report maps how mobile and digital technology facilitate access to climate finance.

Financing instruments profiled



Source: GSMA. (2023). Digitalising Innovative Finance: Emerging instruments for early-stage innovators in low- and middle-income countries





Building on this, the Digitalising Innovative Finance: *Emerging Instruments for Early-Stage Innovators* in LMICs report explores five alternative financing mechanisms that leverage technology to unlock additional private finance. It examines how digital technologies create new structures for blending commercial and impact-driven capital, facilitating the scale-up of innovative utility service models to close service gaps and address climate change.

This includes results-based finance, revenue sharing, receivables financing, alt-lending and carbon markets - an ongoing focus for the GSMA.

The role of digital technologies in strengthening the voluntary carbon market

Positioned to reach a market value of \$50 billion by 2030, the voluntary carbon market (VCM) represents a transformative opportunity for innovation in climate finance. Unlike compliance carbon markets, which are mandated for high-emission industries, the VCM allows companies and individuals to voluntarily purchase carbon credits to offset their emissions. This flexibility not only supports decarbonisation, but also channels critical financial resources to vulnerable communities that often lack access to traditional financing. However, the market has faced an ongoing crisis of confidence. In recent years, its value has contracted - down 61% from its 2021 peak - amid growing concerns over the **quality, integrity and transparency** of carbon credits. Critics argue that inconsistent standards, overclaims and questionable methodologies have eroded trust, with some international bodies openly opposing the VCM as an ineffective climate solution. However, key outcomes from COP29 seek to rebuild confidence by tightening governance, enhancing transparency and improving carbon credit integrity.

Financing through voluntary carbon markets



Source: GSMA. (2023). Digitalising Innovative Finance: Emerging instruments for early-stage innovators in low- and middle-income countries.

On the **supply** side, project developers grapple with fragmented markets, long lead times and significant upfront investments, creating barriers for credit generation. Standards and registries struggle with capacity issues in handling the growing project pipeline exacerbated by the need for accurate, transparent and accessible data required to ensure the integrity of the value chain.

On the **demand** side, buyers seek high-integrity credits to ensure their investments are based on accurate data and represent real, measurable and verifiable emissions reductions. They also demand faster and more transparent price discovery mechanisms to make informed decisions in a timely manner. **Intermediaries** on both sides of the value chain drive up costs and have little incentive to adopt changes that make the market efficient.

Digital innovations are pivotal to unlocking the full potential of the VCM and ensuring genuine climate benefits. As intangible assets, carbon credits derive their value from the data and narrative surrounding a real-world climate action. This makes them well suited for digitalisation, which enables accurate representation, more efficient tracking and streamlined management. This can enhance credibility, safeguard value and streamline the carbon value chain, potentially reducing costs and risks.

The main technologies supporting climate finance are:

- Satellite-based Earth observation methods for the verification of nature-based solutions (NbS) like afforestation or conservation
- Blockchain for addressing the double-counting challenges of carbon credit issuance
- IoT, sensors and drones for data acquisition

Technology not only enhances the credibility of carbon credits, but also makes the market more accessible to those who need it most, paving the way for a more inclusive and effective climate finance ecosystem.

By deploying these digital solutions, we can improve the integrity of the VCM, reduce transaction costs and ensure that the benefits of carbon finance reach the communities and startups driving climate action on the ground.



ClimateTech Horizons



The rise of digital monitoring, reporting and verification

Increasing demands for transparency and traceability have accelerated the adoption of digital monitoring, reporting and verification (dMRV) solutions. These systems leverage digital and mobile technologies - such as IoT. AI. satellites, drones and standardised data exchange APIs - to ensure accurate, real-time data collection across the life cycle of a carbon project. By enabling continuous monitoring, reporting and verification, dMRV not only speeds up reporting, but also improves data accuracy, consistency and interoperability. This helps address long-standing integrity issues in traditional MRV methods while mitigating capacity constraints that hinder market growth.

The GSMA Innovation Fund-backed startup ATEC exemplifies the potential of dMRV with its eCook stove – an IoT-enabled electromagnetic induction stove that delivers clean, affordable cooking for Iow-income households. Through dMRV, ATEC tracks real-time usage data via a mobile-connected IoT server, automatically generating Gold Standard carbon credits. This allows ATEC to keep the upfront cost of the stoves Iow, with additional expenses covered by carbon credits earned through daily usage.

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Digital verification of carbon credits through device data is the only long-term solution for building trust in voluntary carbon markets – as a sector we must ensure a tonne is a tonne.

Ben Jeffreys, ATEC CEO

Spotlight

Navigating the Voluntary Carbon Market: A guide for digital-led startups

Despite the ongoing global debate surrounding VCMs, startups continue to show strong interest in the market. However, for early-stage innovators, entering the VCM can be challenging due to a lack of clear information on costs, project eligibility, certification processes and methodologies.

To address these barriers, the GSMA has launched an online toolkit to help startups navigate the complexities of the VCM. It covers the fundamentals of carbon financing, the costs and benefits, determining project eligibility, as well as various go-to-market strategies. **A standout feature is the breakeven** calculator, which allows enterprises to assess the feasibility of entering the market. By inputting project details, users can estimate the carbon credit prices or project sizes required to break even and project potential earnings.

Alongside this resource, the GSMA is providing **technical assistance to** grantees of the GSMA Innovation Fund for Climate Resilience and Adaptation to help them assess the feasibility of developing and implementing carbon projects and generating high-quality carbon credits in the VCM.

Explore <u>The Voluntary Carbon Market:</u> <u>A guide for startups</u>.



Climate change is one o challenges facing the plu crop yields are estimated due to land degradation	of the most pressing Research fro anet. By 2050, global that mobile d to decrease by 10% accelerate cli and climate change, in LMICs, inc	when the GSMA [2] demonstrates and digital technology can imate investment and financing cluding efforts to address land	
a to new organization with the worst-fifficated or a 50's reduction. As a rest are expected to increase [1]. Healthy land resour ecosystems are key agricultural productivity growing global population continues unabuted, th trigger a reversal from last sink to being a net carbon	In the second se	Ind support smallholder farmes, sns can be applied to generate on data, foster transparency, users, and measure activities to carbon sequestration. The optores digitally enabled cimate linerable communities. Examples regging finted, gene assist nd participating in Voluntary cets, further lilostrated in the	
Although we are all impa- climate change, it does n Low- and middle-incom- are particularly vulnerabl and stresses and require support to adapt to th Despite increasing gi towards climate finance, effectively reach the are most in need remains a s	cted by the effects of not affect us equally. The countrie (LMCG) le to climate shocks e changing climate. bolal commitments ensuring that funds as and communities ignificant challenge.	tions. atte Promote and Patients nore is a broad term used to norial flows towards climate and mitigation initiatives. init	
DIDITAL ANTHREYS TO LAND RE	SLINCE I BAD		

Arabia, the urgency to address land degradation and bolster drought resilience remains paramount. Ahead of the event, the GSMA co-authored a brief with the UNCCD exploring how digital technology can unlock climate finance for land restoration – a critical tool in combating the escalating threats of drought and desertification.

The brief explores how digital solutions, ranging from mobile fintech platforms to digital carbon markets, are demonstrating significant potential in channelling support directly to vulnerable communities and smallholder farmers. By making climate finance more accessible, these innovations are helping to drive meaningful, on-the-ground change.

The discussions at UNCCD COP16 provided an invaluable opportunity to catalyse ambitious actions for sustainable land management and resilience. Now, we must leverage the power of digital innovation to advance sustainable land practices and effective solutions for drought resilience.

Read the full brief <u>here</u>.



ClimateTech Horizons



What's next?

As we look beyond the outcomes of 2024's global negotiations, bridging the climate finance gap remains the top priority. The focus must shift to actionable financial mechanisms that can channel resources effectively to communities at the forefront of climate change. The challenge is not merely about mobilising more capital but about ensuring these funds flow with greater efficiency, transparency and impact.

Technology can be a key enabler. We've seen how innovations like blockchain, Al-driven analytics and dMRV systems are already playing a transformative role. By making finance flows more transparent, bringing down transaction costs and providing realtime data on impact, these tools can address the persistent inefficiencies that have deterred private investment. Mobile and digital-enabled solutions can also enable new financing models that are more flexible and responsive to the needs of vulnerable communities.

However, unlocking climate finance at scale requires greater collaboration between governments, multilateral agencies and the private sector. These actors can co-create platforms and frameworks that de-risk investments and facilitate capital flows into underfunded regions. The emphasis should be on leveraging blended finance approaches that combine public funds with private capital to mitigate risks and attract large-scale investments.

In the near term, the focus should be on scalable solutions that bridge financing gaps while building trust in climate finance mechanisms. By aligning technological advancements with policy reforms and financial incentives, we can move closer to creating a robust climate finance ecosystem that delivers real outcomes for both people and the planet.

Looking ahead

As we conclude this report, the lessons and innovations showcased remind us of the transformative potential of digital technology in tackling climate change. From empowering vulnerable communities to enhancing climate resilience, these solutions are paving the way for a more sustainable and equitable future.

GSMA Mobile for Development remains committed to fostering collaboration across the mobile industry, startups, policymakers and global partners. Together, we can transform bold ideas into action and create solutions needed for the challenges ahead.

Join us on this journey.

To learn more, visit the <u>GSMA ClimateTech website</u> and explore our latest resources.

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