

GSMA M4D Strengthening Climate Action Through Digitalisation: A Formative Evaluation

Evaluation Report

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Acronyms and abbreviations

AI	artificial intelligence
BKK	BaKhabar Kissan (Pakistan)
CaVEx	Carbon Value Exchange (Kenya)
CIU	Central Insights Unit (GSMA)
COP	Conference of the Parties (UN)
CSO	civil society organisation
CSR	corporate social responsibility
DRM	disaster risk management
DRR	disaster risk reduction
EGM	evidence gap map
EPR	Extended Producer Responsibility
EQ	evaluation question
ESR	environmental and social responsibility
EWS	early warning system
FAO	Food and Agriculture Organization of the United Nations
FCDO	Foreign, Commonwealth & Development Office (UK)
FGD	focus group discussion
GHG	greenhouse gas
GIS	Geographic Information System
GSMA	Global System for Mobile Communications Association
ICT	information and communication technology
IoT	Internet of Things
ITU	International Telecommunication Union (Pakistan)
IVR	interactive voice response
KARA	Kenya Alliance of Resident Associations (Kenya)
KII	key informant interview
KPI	key performance indicator
LGU	Local Government Unit (Kenya)
LMICs	low- and middle-income countries
LUMS	Lahore University of Management Sciences
LWMC	Lahore Waste Management Company

M4D	Mobile for Development
M4H	Mobile for Humanitarian Innovation
MEL	monitoring, evaluation and learning
MIH	Mobile Innovation Hub (Indonesia)
MNO	mobile network operator
MoU	memorandum of understanding
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NDMA	National Disaster Management Authority (Pakistan)
NDMA	National Drought Management Authority (Kenya)
NRM	natural resource management
SDG	Sustainable Development Goal
SMS	short message service
SoE	state-owned enterprise
SP	Strategic Partnership (FCDO)
T-CLIRP	Tana River Climate Change and Livelihoods Restoration Project (Kenya)
ToA	theory of action
ToC	theory of change
ToR	terms of reference
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
USF	Universal Service Fund (Pakistan)
USSD	Unstructured Supplementary Service Data
VFM	value for money
WWF	World Wide Fund for Nature

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Disclaimer

The views expressed in this report are those of the evaluators. They do not represent those of GSMA or any of the individuals and organisations referred to in the report.

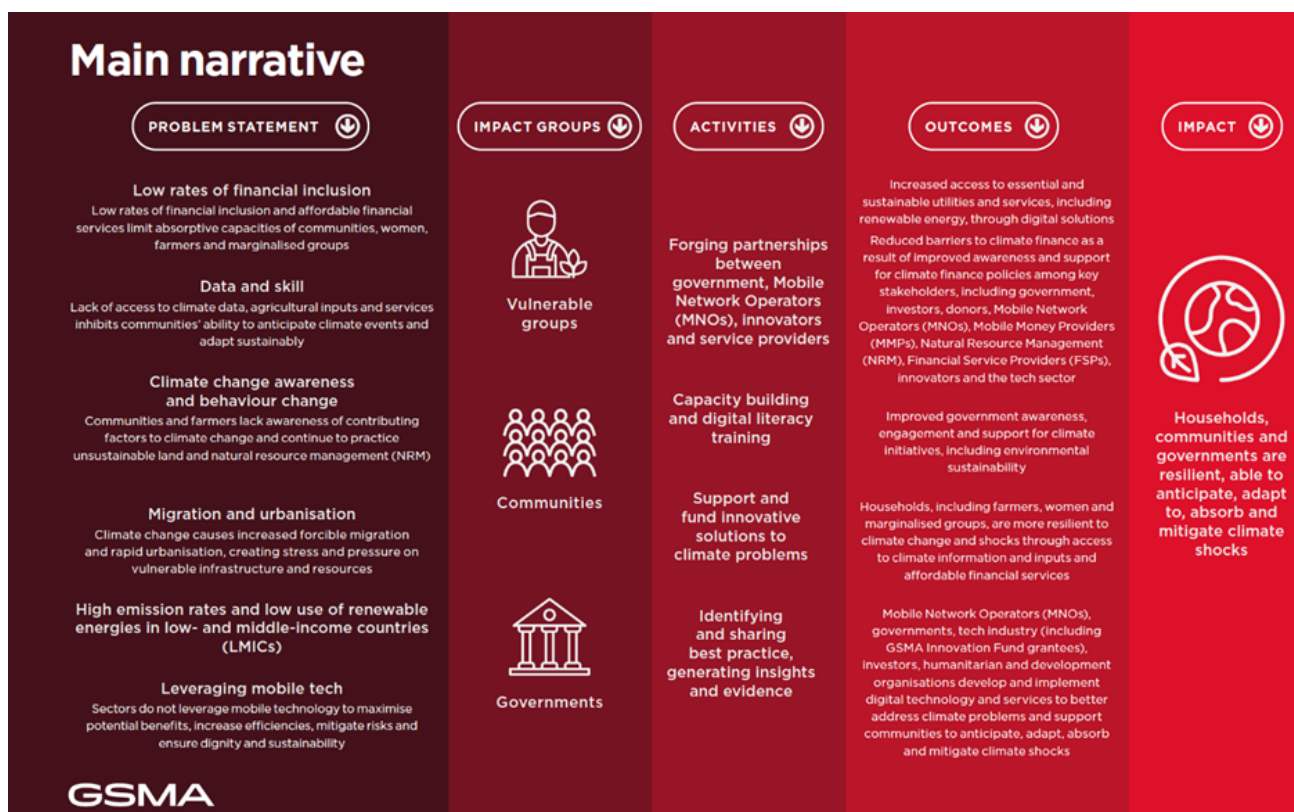
Executive summary

Introduction

This is the final report from a **qualitative, theory based, formative evaluation** of **GSMA M4D Strengthening Climate Action through Digitisation portfolio** conducted between September 2024 and March 2025.

GSMA’s M4D Foundation has been working alongside donors for over a decade to harness the power of mobile technologies to create innovative pathways for addressing the impacts of climate change, as outlined in the Paris Agreement. Since 2020 it has implemented over 90 initiatives in 17 countries, mainly under two Strategic Partnership Agreements between GSMA M4D and the UK Foreign, Commonwealth & Development Office (FCDO). Sida has provided additional financial support for selected climate initiatives under the Strategic Partnership Agreements, while GIZ has funded a separate programme of initiatives in Indonesia.

GSMA’s M4D climate action initiatives aim to take advantage of rapidly changing technologies to mitigate the impacts of climate change and reduce vulnerability at all levels, from poor communities and marginalised groups, to governments. To achieve these aims, GSMA supports the testing and scaling of innovative solutions through the suite of activities that aim to deliver on what is variously referred to as GSMA M4D’s Climate use case or ‘Impact Narrative’ (see Figure below).



Source: GSMA Mobile for Development Climate Impact Narrative, GSMA 2023.

The theory of change (TOC) at the heart of GSMA’s innovation approach is that climate tech can contribute to climate change mitigation, enhanced resilience, and natural resource management at scale with inclusive impacts on the lives of vulnerable people. An implicit theory of action (TOA) is that through a combination of production and dissemination of insights reports, capacity building, funding, and convening/ forging partnerships GSMA can leverage incentives and provide opportunities for actors to collaborate, innovate and learn on how to make tech deliver on its TOC.

Evaluation purpose

The evaluation aimed to generate and consolidate evidence and insights to enable M4D to consider how it can strengthen strategic coherence across the M4D and M4H portfolios. This was with a view to positioning GSMA M4D to play a pivotal role on key issues at the nexus of digital solutions, environmental sustainability and climate resilience. More specifically, the evaluation encompassed research and evaluation to answer three evaluation questions (EQs):

- *EQ1: Establishing an evidence-based theory of change:* According to the wider evidence base, how and under what conditions do digital technologies contribute to climate change mitigation, adaptation, resilience and natural resource management and environmental sustainability?
- *EQ2: Testing the GSMA M4D climate tech ‘use case’ or theory of action:* How, why and to what extent is GSMA’s M4D climate approach likely to have anticipated impacts in areas of climate change mitigation, adaptation, resilience and natural resource management and environmental sustainability for target populations?
- *EQ3: Drawing conclusions and recommendations:* What is M4D’s potential niche and what are the opportunities for M4D’s approach to digital tech innovation and collaboration to have a strategic impact on climate action to address climate vulnerability?

Findings and conclusions

Overall, the exploration of EQ1 through an [Evidence Gap Map](#) and extensive [literature review](#) suggests that there is empirical evidence that **digital technologies have most impact when they are part of a broader, holistic strategy that seeks to understand, navigate and shift the systems (including institutions, relationships and governance) that reinforce climate vulnerability and constrain climate mitigation and sustainable natural resource management (NRM)**. The empirical evidence base on the role of mobile digital technologies for climate action is limited and uneven. Nonetheless, it suggests that mobile technology can play an important role in information provision and communication that incrementally strengthens individuals’ anticipatory and absorptive adaptation capacities. However, numerous contextual factors (from programme design to people’s resources and capacities) significantly affect access to, uptake and impact of mobile digital technologies.

Turning to EQ2 explored through portfolio mapping, primary case studies and analysis of secondary data, including GSMA’s own learning we find that most elements of the approach described in the impact narrative have been tested. However, as might be expected in a formative evaluation there has been more focus on enhancing household resilience and improving digital utility access than on GSMA’s newer ambitions regarding climate finance and NRM. With this in mind, we find that **GSMA’s innovation approach to climate action is likely to lead to moderate, context-dependent impacts, with stronger potential when aligned with commercial incentives of key stakeholders and government priorities. GSMA’s approach to climate action and mobile tech innovation is relevant and effective in engaging key stakeholders. However, they face common structural, technical, political, economic, social and behavioural challenges. These conditions, as well as various organisational constraints, particularly the absence of country strategies, make it challenging to contribute to climate change mitigation, adaptation, resilience, natural resource management and environmental sustainability benefiting target populations at scale.**

Evidence indicates that the innovation approach is largely functioning as intended. GSMA’s catalytic funding, technical support and convening power (particularly in collaboration with MNOs) effectively align the commercial incentives of MNOs, start-ups and financial institutions with climate objectives. GSMA-supported initiatives have also heightened government awareness of the potential of climate tech and fostered greater willingness to experiment and learn. Notably, there are emerging

examples where technology is enabling carbon markets, with important implications for climate finance transactions in the future. Furthermore, use cases involving Internet of Things-based climate and agriculture advisory services and SMART emissions-reducing technologies demonstrate how mobile technology can help mitigate emissions, enhance both absorptive and anticipatory resilience of select populations as well as NRM. While this is encouraging (and increasingly integrating artificial intelligence), GSMA's experience shows that there remain risks of overestimating technology's potential. Although simple technological features perform well, ensuring tech solutions are accessible, useful, usable and able to play a role in meaningful adaptation with significant impacts for diverse populations at scale remains challenging.

Drawing conclusions relating to EQ3, **GSMA's strategic niche in the climate action ecosystem is to leverage its connections to MNOs and mobile digital innovation to further technologies and partnerships that advance climate change impacts across commercial, non-commercial and combined models. The opportunities for GSMA M4D's approach to realise this potential and have strategic impact involve more intentional and robust understanding of the climate ecosystems it engages with, and working more effectively with local and other actors.** This would entail updating its Climate Action theory of change to be more consistent with the broader evidence on climate action and developing country strategies. GSMA should make adjustments to its strategic planning and implementation to build on and deepen its organisational niche, role, practices and strengths for understanding, connecting, supporting and strengthening climate tech businesses, MNOs and other climate actors and approaches. Pursuing its niche in this way would enable it to more effectively leverage mobile digital technologies for meaningful, inclusive and sustainable climate impacts.

Recommendations

To build on GSMA's strengths while making a more meaningful contribution to climate impacts we make the following recommendations for different stakeholders

For FCDO

1. Review and update GSMA Strategic Partnership (SP)3 with respect to the M4D climate portfolio

The strategic findings of this evaluation will need to be discussed and agreed with FCDO in the context of the new SP3. We recommend the following actions:

- *Review and update the SP3 theory of change*
- *Review and update SP3 key performance indicators*
- *Agree on SP3 priority geographies*
- *Align resource allocation for research and innovation to priority geographies*
- *Strengthen engagement and support from FCDO country offices in priority geographies*

For GSMA management

2. Target priority geographies

This evaluation finds that GSMA's strategic positioning and potential for impact are strongest when focused on understanding and engaging a specific and contextualised ecosystem of mobile digital and climate actors and factors. This strongly suggests a relative rebalancing of focus towards priority geographies. We recommend the following actions:

- *Select priority countries based on alignment, opportunity and need*
- *Align resources to deepen support in priority geographies*
- *Align and leverage all parts of GSMA (Mutual, Foundation, etc.)*

3. Articulate, adopt and integrate GSMA essential principles for effective partnerships

Given the importance of partnerships to GSMA's niche, role and positioning, it should develop a set of principles to inform its partnership approach and practices, exploring (and possibly adapting) the principles of the Digital Impact Alliance.¹

4. Adapt the Innovation Fund

The evaluation suggests that adapting the Innovation Fund would make it more effective in supporting the partners and innovations that are most likely to contribute to inclusive, meaningful and sustainable climate change impacts. We recommend the following actions:

- *Update selection criteria based on priority countries and evidence of effective approaches*
- *Streamline the application and selection process*
- *Build more flexibility and learning into grants*

5. Clarify and strengthen the MEL system

Consistent, robust and practical monitoring, evaluation and learning systems, indicators and practices are essential to support innovation and impact, and to contribute to the broader evidence base. Despite finding some excellent recently developed frameworks, the evaluation encountered significant evidence gaps across the M4D climate portfolio. This made it challenging to assess what, how and why change was (or was not) happening, particularly around the climate change outcomes and impacts GSMA is working towards. GSMA should invest in an organisation-wide process to develop an MEL system that is fit for purpose, and has buy-in from across the organisation. The process should include identifying and agreeing on priority learning questions at portfolio and programme levels. It should address the need for a strong culture and enabling environment for evaluation and learning, as well as adequate frameworks, resources, roles and practices.² We recommend the following actions:

- *Strengthen tools and practices for identifying and tracking intermediate and longer-term outcomes.*
- *Consider more embedded research and ex-post evaluation*
- *Adapt MEL for the Innovation Fund and priority geographies*

For the M4D team

6. Update and strengthen the M4D climate strategy

This evaluation suggests that GSMA would benefit from revising its M4D climate strategy. Documents like the Climate Impact Narrative are more descriptive than explanatory. Tools like the Climate Tech theory of change articulate more comprehensive thinking on how GSMA

¹ The partnership principles from the Digital Impact Alliance include: trust (build confidence for adoption through inclusion, transparency and accountability); people-centred (partnerships and technology focus people and real human challenges, not just technological solutions); outcome-focused (success is measured through shared metrics focused on impact, not just uptake of technology); sustainability (integrating technology into partnerships and systems for relevance, continuity and long-term impacts); country-driven/globally informed (avoid generalised solutions, rather countries prioritise and lead while drawing on global evidence and experience).

² For example, see: <https://www.fsg.org/resource/building-strategic-learning-and-evaluation-system-your-organization/>

contributes to its overall outcomes, but still rely on significant assumptions that do not fully reflect the available evidence. This evaluation has sought to present evidence and insights that could be incorporated into a clearer, stronger and shared climate strategy to inform the work of the teams implementing the M4D climate portfolio, both at global level and in priority geographies. We recommend the following actions:

- *Update and clarify climate change outcomes*
- *Update and clarify the overall theory of change*
- *Develop practical guidance for the implementation strategy*

7. Clarify and strengthen a whole-of-GSMA role and approach in priority geographies

The evaluation found evidence of good practices but also fragmentation in the two country case studies (Kenya and Pakistan, see annexes 6 and 7). There was evidence that politically savvy and well-connected staff played an instrumental role in brokering and connecting that enabled partnerships and joint efforts to get off the ground. There were also cases of teams working in isolation and failing to explore synergies. Overall, there was no consistent and coherent approach to leveraging GSMA's role and resources in a given geography. We recommend the following actions:

- *Articulate GSMA's approach to engaging with partners and other stakeholders*
- *Co-create strategies for priority geographies*

8. Clarify and strengthen the approach of the Digital Utilities programme

The evaluation found significant strengths in the Digital Utilities programme, particularly its role in brokering collaborations and partnerships among government and private sector actors around developing and scaling mobile digital technologies. However, some programme partners did not have clear evidence of (or an adequate approach for) achieving inclusive, meaningful and sustainable climate change outcomes. In the context of updating and strengthening the M4D climate strategy and practical approach (recommendation 6c), there is an opportunity for GSMA to both draw on and strengthen lessons and practices from the Digital Utilities programme. We recommend the following actions:

- *Clarify and strengthen alignment with climate outcomes and vulnerable populations needs*
- *Deepen analysis of service challenges and gaps*
- *Clarify and strengthen partners' strategies for achieving inclusive climate outcomes*
- *Develop guidance for brokering and convening, including more intentional engagement with civic actors embedded in and/or representing vulnerable urban populations*

9. Strengthen insight work

The evaluation suggests that there is an opportunity to strengthen the reach, uptake and influence of GSMA insight efforts. This would involve exploring the relatively low usage rates of Insight reports, to inform the development of an explicit outreach approach for each individual report. There should be greater emphasis on engaging stakeholders (including all GSMA teams and partners) and other audiences when developing evidence and recommendations for insight reports, to strengthen buy-in and outreach. The evidence used to inform insight reports and case studies should be clarified and strengthened.

10. Focus and strengthen engagement in the Pakistan climate ecosystem

Based on the case study developed for this evaluation (see Annexe 7), we recommend that GSMA explores potential for re-engaging the Smart Villages programme. This should include mapping and engaging with other actors and efforts in the broader climate ecosystem, and aligning GSMA's current and future partnerships and support with this. If initial explorations are promising, this could be incorporated as an entry point in a Pakistan country strategy.

11. Focus and strengthen engagement in the Kenya climate ecosystem

Based on the case study developed for this evaluation (see Annexe 6), we recommend that GSMA explore alignment between Safaricom, 4R Digital's CaVEx platform, community forestry associations and World Vision Kenya around carbon markets and sustainable NRM. If initial explorations are promising, this could be incorporated as an entry point in a Kenya country strategy.

1. Introduction

This is the final report for the **GSMA Mobile for Development (M4D) Foundation Strengthening Climate Action Through Digitalisation: A Formative Evaluation of Contributions and Potential**. This section sets out the evaluation's context, purpose and scope. It also outlines the structure of the report, together with a plan for communicating and using the evaluation findings to inform improvements in programming.

1.1 Context, purpose and scope of the formative evaluation

GSMA's M4D Foundation has been working alongside donors for over a decade to harness the power of mobile technologies to create innovative pathways for addressing the impacts of climate change, as outlined in the Paris Agreement. However, until recently, links between this work and climate action have been somewhat implicit.³ A retrospective portfolio mapping of related GSMA activities (2020–24) undertaken by the evaluation team sought to make these links more explicit. It identified more than 90 diverse initiatives in over 17 countries, mainly under two Strategic Partnership Agreements between GSMA M4D and the UK Foreign, Commonwealth & Development Office (FCDO).⁴ One focused on Mobile for Development, and the other Mobile for Humanitarian Innovation (M4H).⁵ A significant proportion of the £38.265m allocated under FCDO Strategic Partnerships for the period 2019 to 2025⁶ was allocated to climate action – for example, in the 2023–24 financial year, £3.76m⁷ of its £6.69m⁸ annual spend is categorised as climate finance. Sida has provided additional financial support for selected climate initiatives under the Strategic Partnership Agreements,⁹ while GIZ has funded a separate programme of initiatives in Indonesia.¹⁰

GSMA's M4D climate action initiatives aim to take advantage of rapidly changing technologies to mitigate the impacts of climate change and reduce vulnerability at all levels, from poor communities and marginalised groups, to governments. To achieve these aims, GSMA supports the testing and scaling of innovative solutions through the suite of activities or interventions that comprise the portfolio described above. These aim to deliver on what is variously referred to as GSMA M4D's Climate use case or 'Impact Narrative' (see Figure 1).¹¹

³ This 2021 report outlines possible areas [The Role of Digital and Mobile Enabled Solutions in Addressing Climate Change-Final..pdf \(gsma.com\)](#)

⁴ [DevTracker Programme GB-1-203804 \(fcdo.gov.uk\)](#)

⁵ [DevTracker Programme GB-GOV-1-300446 Documents \(fcdo.gov.uk\)](#)

⁶ FCDO Annual Review Report 2024

⁷ GSMA ICF reporting for financial year 2023-24 (List of ICF reporting FY23-24 GSMA – updated.xlsx) which reported spending of £3.76m on climate related activities.

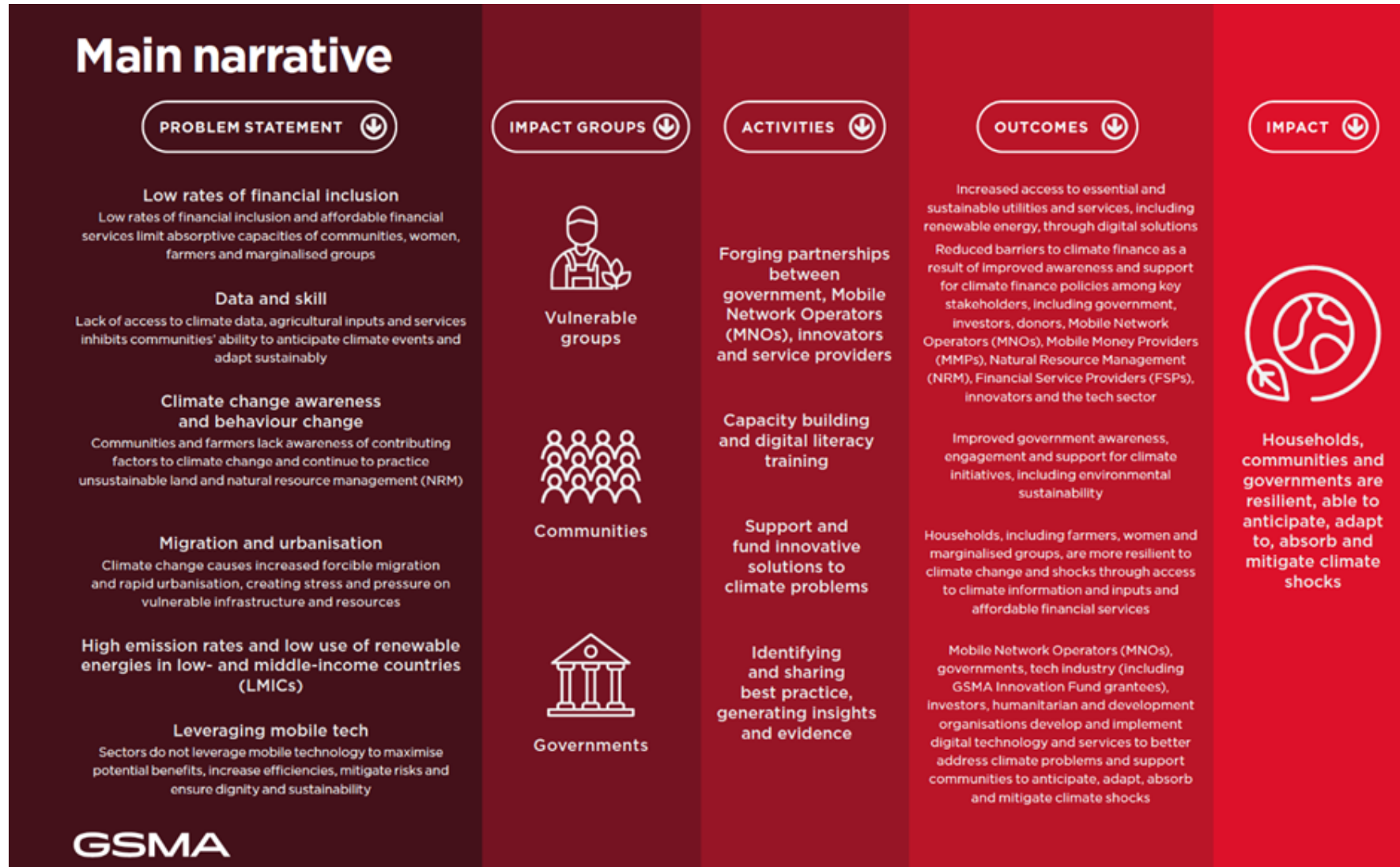
⁸ GSMA M4D 2024 Annual Review report

⁹ KII Donors

¹⁰ GSMA (2022) *The state of mobile-enabled climate technology in Indonesia*

¹¹ We consider this a programme theory

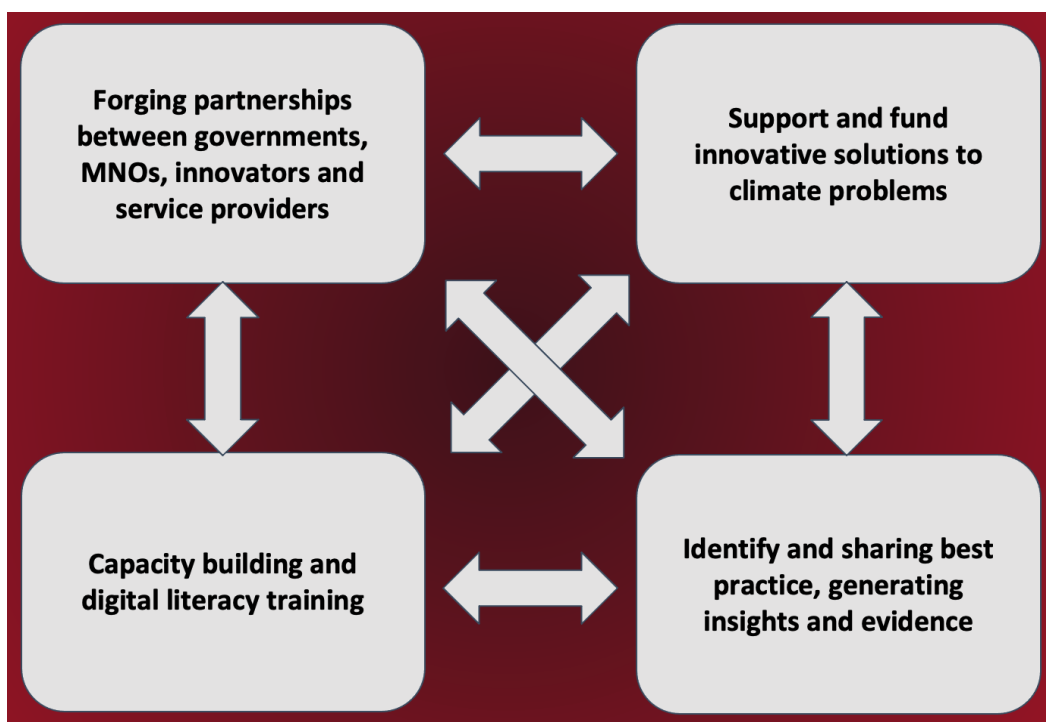
Figure 1: GSMA M4D Climate Impact Narrative



Source: GSMA Mobile for Development Climate Impact Narrative, GSMA 2023.

The GSMA Climate Impact Narrative describes an innovation model comprised of four distinct yet interconnected and mutually supportive activity areas that contribute to outcomes according to an implicit theory of change (ToC) and theory of action (ToA). These are: forging partnerships; capacity-building; supporting and funding initiatives (primarily through its Innovation Fund); and identifying and sharing best practice, often using GSMA M4D insights and evidence reports (see Figure 2).

Figure 2: GSMA M4D innovation model



Source: Evaluation team (developed to illustrate the activities and reinforcing links of the implicit innovation model in the GSMA Climate Impact Narrative).

Interconnected activities called climate action ‘initiatives’ are implemented to test this innovation model, usually in partnership with other actors in climate action ‘ecosystems’ in the 17 countries as well as globally. These are managed and facilitated by GSMA M4D’s Climate Tech, Digital Utilities, M4H and Digital Inclusion programme teams, supported by an Innovation Fund team, Central Insights Unit and, in some countries, GSMA Mutual.¹² Many of the initiatives are managed by staff located in GSMA M4D’s London office, while others are overseen by hubs or groups of regional staff in Kenya and India.

The nature of the portfolio and GSMA M4D’s structure and ways of working mean that Climate Action initiatives are not informed by explicit country strategies based on specific analysis of country policy contexts as they relate to poverty reduction, gender equality, environmental protection and human rights. Nonetheless, all are informed by a global policy context in which climate change is understood to be impacting vulnerability, which influences poverty and environmental sustainability, disproportionately impacting women and other vulnerable groups.¹³

¹² KIIs GSMA staff UK and Pakistan. GSMA Mutual is a separate section of GSMA from GSMA M4D.

¹³ KIIs GSMA staff in UK; GSMA FCDO Annual Review Report 2024; GSMA Impact Narrative

The climate actions tested by GSMA thus far have tended to focus on agriculture, energy, waste management and early warning responses.¹⁴ They involve partnerships with private sector actors such as mobile network operators (MNOs) and start-ups that are assumed to have commercial and social impact incentives. GSMA M4D also works with governments and public sector actors keen to improve utilities and service delivery, particularly in urban areas where the impacts of climate change (such as floods) present huge challenges.¹⁵

As with the UK government,¹⁶ GSMA M4D is keen to make climate and climate finance more central to its development work. To bring together its diverse areas of climate work in one framework, and assess its potential to contribute to effective climate action, GSMA commissioned a **theory-based, formative learning evaluation**.¹⁷

1.1.1 Aim of the evaluation

This formative evaluation was conducted between **September 2024 and March 2025** at the end of GSMA and FCDO's Mobile for Development Strategic Partnership Phase 2 and ahead of their upcoming Strategic Partnership Phase 3, which was due to start in April 2025. The evaluation aimed to generate and consolidate evidence and insights to enable M4D to consider how it can strengthen strategic coherence across the M4D and M4H portfolios. This was with a view to positioning GSMA M4D in such a way that would reflect its potential to play a pivotal role on key issues at the nexus of digital solutions and climate resilience. More specifically, the evaluation set out to encompass research and evaluation to understand:

- In what ways digital solutions can expect to contribute to climate action – including mitigation, adaptation and resilience.
- The totality of M4D's climate portfolio, and the extent to which M4D's climate work has contributed to climate action or would have the potential to, in the future, with adaptations to programme design models.

As such, this evaluation aimed to deepen understanding of how and why various uses of digital technology can contribute to climate change mitigation, adaptation, resilience, natural resource management (NRM) and environmental sustainability at different levels, for different impact groups, and in different contexts. It also aimed to answer questions on whether and how digital technology can be leveraged more strategically and effectively through GSMA's M4D innovation model¹⁸ in the future.

Addressing these issues required the evaluation team to contextualise GSMA's work within the wider evidence on climate action. It required engaging with the implicit value proposition that GSMA is best qualified and placed to support, test, research and support advocacy and learning that increases the use of digital technologies for climate action at scale.

¹⁴ Evaluation Team analysis of portfolio mapping; KIIs with GSMA staff.

¹⁵ KIIs with GSMA staff; Evaluation Team portfolio mapping.

¹⁶ [The Kew Lecture: Foreign Secretary's speech on the climate crisis - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/speeches/the-foreign-secretary-s-speech-on-the-climate-crisis)

¹⁷ We note that formative evaluation is not identified in the FCDO Equals framework and understand it as distinct from developmental evaluation. Whereas developmental evaluation supports adapting and changing an innovation for ongoing development, formative evaluation supports improving a model in preparation for summative evaluation. [Michael Quinn Patton on developmental evaluation as alternative to formative assessment | Better Evaluation](#). In this context we understand the model to be GSMA's approach to digital tech innovation for climate action mostly in the areas of climate change adaptation and resilience.

¹⁸ The term 'innovation model' is used here to describe all of the work GSMA M4D does to support the scaling of innovative technology for climate action, not only that funded by the Innovation Fund, though this is an important component of the model.

1.2 Structure of the report

Section 2 describes the methodological approach for the evaluation, its implementation, and key limitations. Section 3 is organised to speak directly to the EQs and sub-EQs. We start by establishing the evidence base (EQ1) – the conditions under which digital technologies contribute to climate change mitigation, adaptation, resilience, NRM and environmental sustainability. We then synthesise the data (EQ2) from the portfolio mapping and interviews on the extent of M4D’s portfolio implementation and the quality of outputs (Section 3.2.1). The following sections summarise evidence on the contribution of GSMA’s initiatives to environmental sustainability (Section 3.2.2) and broad outcomes (Section 3.2.3) before exploring insights on how and why initiatives contribute to outcomes (Section 3.2.4). Section 3.2.5 briefly discusses organisational factors that affect implementation and potential strategic impact. Section 3.3 includes an assessment of GSMA M4D’s implicit Climate Action ToC, with reference to the literature. We then apply this to exploring the relative strengths of different GSMA M4D approaches and how GSMA can strengthen its niche, along with actionable recommendations.

The evaluation report uses a pyramid writing style: we present a headline finding for each EQ and sub-EQ followed by an analysis of the evidence that supports it.

Referencing approach: Whenever we draw on evidence from the literature review (EQ1), we cite relevant page numbers. In EQ2.1, the discussion on implementation draws on a [portfolio mapping](#), whereas the quality of outputs analysis draws on key informant interviews (KIIs), focus group discussions (FGDs) and informal conversations, and includes footnotes referencing primary research and our own analysis of insight reports (Annexe 1). There are also references to primary research sources in findings on EQ2.2. Evidence on specific initiatives supporting analysis in EQ2.3, EQ2.4, EQ3.1, EQ3.2 and EQ3.3 can be found in the ‘Outcome analysis’ (Annexe 4), which collates the sources of evidence (mostly secondary) used in our light touch analysis of whether and why different initiatives are progressing towards their intended outcomes. This Annexe also supports two country case studies: one on Kenya (Annexe 2), and one on Pakistan (Annexe 3). EQ2.5, which focuses on GSMA’s organisational context, references primary research encounters.

1.3 Communicating and using the evaluation findings

This formative evaluation was designed to maximise the use of findings to drive learning and inform strategic decision-making within GSMA M4D’s climate portfolio. The primary audience comprises internal stakeholders, including M4D climate teams, the wider M4D programme, donors such as FCDO and Sida, and key delivery partners who are directly engaged in or affected by GSMA’s initiatives. The central aim is to ensure that evaluation insights foster critical reflection, contribute to improved programme design and implementation, and support evidence-based allocation of resources. Evidence gaps also need to be openly addressed, particularly in portfolio mapping and outcome measurement, to maintain transparency and rigour.

To embed our findings, the evaluation’s conclusions and recommendations will be systematically incorporated into management discussions, team learning forums, and strategic planning processes. This ongoing integration will help refine monitoring frameworks and ensure that programme adaptations incorporate lessons learnt but also reflect remaining uncertainties. Targeted feedback mechanisms (such as reflection sessions and team discussions) will be organised to maintain stakeholder engagement, and to monitor how evaluation insights are influencing programme directions and decisions.

Recognising that the evaluation presents several recommendations that require careful consideration and time to implement, ongoing dialogue between FCDO and GSMA will be critical. Such engagement will determine which recommendations to prioritise and how to adapt them to current contexts. This collaborative process will inform the adaptation and design of the upcoming FCDO Strategic Partnership 3 phase and guide the further development of M4D's climate strategy, ensuring that the evaluation contributes to long-term programme improvement and impacts on key target groups, vulnerable households, communities and government actors.

2. Evaluation methodology

2.1 Evaluation design and proposed methods

Three evaluation questions (EQs), revised from those in the original terms of reference (ToR) following an evaluability and feasibility assessment (Annexe 3), guided the theory-based qualitative approach:

- *EQ1: Establishing an evidence-based theory of change:* According to the wider evidence base, how and under what conditions do digital technologies contribute to climate change mitigation, adaptation, resilience and natural resource management and environmental sustainability?
- *EQ2: Testing the GSMA M4D climate tech 'use case' or theory of action:* How, why and to what extent is GSMA's M4D climate approach likely to have anticipated impacts in areas of climate change mitigation, adaptation, resilience and natural resource management and environmental sustainability for target populations?
- *EQ3: Drawing conclusions and recommendations:* What is M4D's potential niche and what are the opportunities for M4D's approach to digital tech innovation and collaboration to have a strategic impact on climate action to address climate vulnerability?

The formulation of these EQs, which aligned closely with the GSMA M4D use case and ToA/ToC, served as the primary analytical framework for the evaluation.

EQ1, a literature review, focused on some key themes of particular interest to GSMA highlighting the extent and nature of evidence on successful tech and non-tech supported approaches to climate change mitigation, adaptation, resilience, NRM and environmental sustainability.

EQ2, a more evaluative question, involved analysis of secondary documentation and literature as well as primary research to explore whether, how and why GSMA's interventions had achieved, or appeared likely to achieve, their outcomes.

EQ3 was a concluding question. The team brought together findings and analysis from EQ1 and EQ2 to inform conclusions on the appropriateness of GSMA M4D's problem analysis and the assumptions in its ToC, and to establish its potential niche. The conclusions would inform recommendations on how GSMA M4D could improve the strategic climate impact of digital tech and collaboration. Recommendations would include any necessary adjustments to the ToC underpinning GSMA M4D's innovation model and Impact Narrative.

The evaluation approach and methods were shaped by insights from the evaluability assessment (Annexe 3). Although the portfolio was theoretically evaluable, its fragmented nature posed challenges in identifying relevant initiatives, accessing monitoring data, and generating meaningful insights. In response – and recognising differing interpretations of the evaluation's purpose within GSMA – we adopted a collaborative approach. GSMA M4D staff played a central role in multiple phases of the evaluation. Additionally, GSMA agreed that the evaluation team would need to take

an adaptive and opportunist approach that combined breadth through a portfolio review with two more in-depth case studies, one in Kenya and the other in Pakistan.

Table 1 describes the methods and data sources that were proposed to answer sub-questions and generate the evidence to be assessed through the evaluation framework (described above).

Table 1: Evaluation matrix

Evaluation question	Methods	Data sources
EQ1. Establishing an evidence-based theory of change: how and under what conditions do digital technologies contribute to climate change mitigation, adaptation, resilience and sustainable natural resource management and environment?		
EQ1.1. According to the wider evidence base, how, and under what conditions do digital technologies contribute to climate change mitigation, adaptation, resilience, NRM and environmental sustainability?	<ul style="list-style-type: none"> ● Literature review ● Evidence gap map 	GSMA M4D reports Academic literature Grey literature
EQ2. Testing the GSMA M4D climate tech ‘use case’ or theory of action: how, why and to what extent is GSMA’s M4D climate approach likely to have anticipated impacts in areas of climate change mitigation, adaptation, resilience and natural resource management and environment for target populations?		
EQ2.1 What is the extent of implementation of activities and quality of outputs being achieved? <ul style="list-style-type: none"> ● Identifying, generating and sharing insights and evidence ● Supporting and funding innovative solutions ● Forging partnerships between different stakeholders ● Capacity-building and digital literacy 	<ul style="list-style-type: none"> ● Mapping of the entire portfolio involving GSMA staff: <ul style="list-style-type: none"> ● GSMA monitoring, evaluation and learning (MEL) document reviews ● Key informant interviews (KIIs) 	<ul style="list-style-type: none"> ● Insight reports; outcome harvest monitoring reports; evaluation reports; baseline, endline, scaling and planning documents for innovation grantees; scaling and planning documents for innovation grantees; flagship reports ● GSMA staff, FCDO, grantees, MNO partners, UN representatives, GSMA partners providing capacity-building support to Innovation Fund grantees
EQ2.2. What is the evidence to suggest GSMA’s initiatives and that of its partners are environmentally sustainable? Why?	<ul style="list-style-type: none"> ● Document review by climate experts ● Key informant interviews 	<ul style="list-style-type: none"> ● 3 grantee environmental assessments; relevant flagship report; ● Yet to be identified
EQ2.3. Are interventions effective? To what extent have activities and outputs under EQ2.1 contributed to outcomes? To what extent do these outcomes map on to those outlined in the Impact Narrative?	<ul style="list-style-type: none"> ● Portfolio review <ul style="list-style-type: none"> ○ Document reviews ○ Select KIIs ● Country case analysis <ul style="list-style-type: none"> ○ KIIs 	<ul style="list-style-type: none"> ● As for EQ2.1 ● GSMA staff in regions; selected grantee partners, MNO representatives, other

Evaluation question	Methods	Data sources
	<ul style="list-style-type: none"> Contribution and quality of evidence rubric assessment¹⁹ 	<p>private sector representatives, government partners, advocacy targets such as international development partners, academic climate experts in Kenya and Pakistan</p>
<p>EQ2.4 What are the enabling and disabling conditions that help or hinder implementation and the effectiveness- the achievement of outcomes and impacts in case study countries? For example</p> <ul style="list-style-type: none"> Relevance, coherence and alignment with local priorities? The mobile ecosystem and other economic, political, regulatory and social contextual factors ? 	<ul style="list-style-type: none"> Portfolio review <ul style="list-style-type: none"> Document reviews Select KIIs Country case analysis <ul style="list-style-type: none"> Policy document review KIIs Realist-inspired content analysis where feasible 	<ul style="list-style-type: none"> As for EQ2.1 Relevant policy and context literature and documents GSMA staff in regions; selected grantee partners, MNO representatives, other private sector representatives, government partners, advocacy targets such as international development partners, academic climate experts in Kenya and Pakistan
<p>EQ2.5 How does the GSMA programme context influence the efficiency and effectiveness of outputs and outcomes?</p>	<ul style="list-style-type: none"> Budget analysis Document review KIIs Realist-inspired content analysis where feasible 	<ul style="list-style-type: none"> GSMA programme and grant budgets Insight pieces focusing on Innovation Fund applications GSMA staff, grantee partners, consultants providing support to grantee cohort, FCDO representatives
<p>EQ3. Drawing conclusions: What are the opportunities for M4D’s approach to digital tech innovation and collaboration to have a strategic impact on climate action to address climate vulnerability?</p>		
<p>EQ3.1. What does evidence from EQ1 and EQ2 suggest about the appropriateness of M4D’s current use case regarding digital tech innovation for climate action and mitigation, adaptation, resilience, NRM and environmental sustainability?</p>	<ul style="list-style-type: none"> Analysis of findings from evaluative work against evidence from the literature review 	<ul style="list-style-type: none"> Literature review output Portfolio mapping report Country case notes
<p>EQ3.2. What is M4D’s potential niche and where are the opportunities for M4D’s approach to digital tech to have a strategic impact on climate action to address climate vulnerability?</p>	<ul style="list-style-type: none"> Collaborative sensemaking with GSMA 	<ul style="list-style-type: none"> Output of analysis from EQ3.1

¹⁹ This simple rubric is adapted by those developed by Tom Aston for FCDO. It considers the *credibility/plausibility* of links between interventions and outcomes, and *triangulation* – the number and quality of evidence sources.

Evaluation question	Methods	Data sources
EQ3.3 What strategic and implementation adjustments would be needed to realise this impact?	<ul style="list-style-type: none"> Collaborative sensemaking with GSMA 	<ul style="list-style-type: none"> Output of analysis from EQ3.1

None of the EQs focused on gender equality or equity. However, these were primary considerations in our review of evidence (EQ1) on vulnerability and in our concluding analysis on the appropriateness of GSMA's problem analysis and ToC.

2.2 Methodology implementation and limitations

In this subsection, we describe how each stage of the evaluation methodology was implemented, followed by details of the challenges involved and limitations of the approach.

2.2.1 EQ1: A literature review and evidence gap map were implemented as planned

The evaluation team undertook [an evidence gap map \(EGM\)](#) on the effectiveness of mobile digital technology for climate action related to mitigation, adaptation, resilience, NRM and environmental sustainability. The EGM identified 144 empirical studies. These were included and expanded on in a broader [review of the literature on climate action for mitigation, adaptation, resilience, finance, governance and sustainable NRM](#). GSMA's own evidence was included to an extent, but the emphasis was on bringing in new evidence and perspectives from the academic and grey literature.

The discussion of findings for EQ1 in this report summarises key points from both the EGM and the literature review. (See the scoping note for the literature review (Annexe 4), and the description of the EGM process and protocol (Annexe 5).)

Challenges and limitations

The EGM revealed significant unevenness in the empirical evidence base. Some climate actions, outcomes, populations and enablers related to mobile digital technology were well covered, whereas others were not covered at all. Many of the studies focused narrowly on specific technologies and short-term outcomes, often lacking analysis of climate vulnerabilities or use of technology in broader climate action strategies. The studies also tended to focus on explicit use of technologies for particular climate actions, with only limited evidence on the everyday uses of digital technology²⁰ in the context of climate change. Given these constraints in the evidence base, there are limits to the conclusions that can be drawn with a high level of confidence for most uses of digital technologies for climate action (although some notable exceptions are discussed in Section 3.1).

The literature review undertaken to inform EQ1 was extensive but not exhaustive, given the breadth of the relevant climate content areas. The inclusion of numerous meta-analyses and prior literature reviews does enable a higher level of confidence in the overall findings given that they build on a broad basis of well-established evidence and conclusions.

2.2.2 EQ2: The core evaluation team worked with in-country teams to implement data collection and analysis

Although we looked superficially at the ToC during the evaluability assessment, we did not formally unpack either the ToC or the ToA with the GSMA team to inform the approach to EQ2. Given time constraints and the fragmented nature of GSMA's portfolio, our priority was to identify relevant

²⁰ By everyday use, we mean the use of information and communication technology (ICT) such as email, WhatsApp and the internet, which are pervasive within many societies, as opposed to the specific use of technologies for the purposes of climate action.

initiatives and develop an approach and interview guides that explored whether, how and why interventions were working as expected, or not. Findings were to be analysed using the theories of action and change under EQ3.

We began the evaluative work (EQ2.1) by trying to [map GSMA M4D's entire climate action portfolio](#)²¹. This involved reviewing key documents and interviewing staff with a broad set of generic questions to gain a deeper understanding of how the climate portfolio had emerged over time. Interview questions also explored staff and stakeholder perceptions of the strengths and weaknesses of GSMA M4D's climate action work. Interviews aimed to elicit important lessons learnt, and ask what staff and key stakeholders were hoping to gain from the evaluation. Where possible, areas of inquiry were aligned with the interests of GSMA M4D's key donors, FCDO and Sida.

We then proceeded with the country cases studies (annexes 6 and 7), developing ToR (annex 8) and hiring in-country researchers. Given the complex nature of the portfolio and researcher inexperience with formative evaluation, the core team worked closely with country researchers on testing and iterating the evaluation design and tools. For the case studies, we started by trying to map all the GSMA M4D 'initiatives' that related to the climate portfolio in each of the two countries, organising and reviewing secondary data to identify a purposive sample of initiatives (around 10 in Kenya and 10 in Pakistan), along with possible respondents. We also developed customised interview guides in efforts to fill gaps rather than go over established ground.

An analysis template was drawn up for internal use by the team to capture and structure the data and analysis for each 'initiative' in response to EQ2.3 and EQ2.4. This included data on the context, the actors involved, the nature and aims of each initiative, emergent outcomes, and insights into how and why interventions were working (or not), implicitly using realist thinking. The intention was for template content to be iterated in real time as we discovered relevant secondary data and proceeded with conducting interviews.

We communicated closely with the GSMA M4D Monitoring, Evaluation and Learning (MEL) team throughout to try and avoid duplication with other past or current GSMA evaluations and to avoid respondent fatigue. We then set up interviews with key stakeholders. These were initially conducted by both core and country evaluation team members (mostly online), followed by reflections on content and methods, which generated suggestions on how to improve interviewing techniques. Country team researchers later conducted interviews alone and also undertook context analysis using secondary data sources.

In addition to the initial sample of initiatives driven by our country case study choices, we purposively selected several mature and successful initiatives that were well-documented, to feature in the analysis of outcomes (EQ2.3). Where possible, we complemented documents with interviews involving key GSMA staff and other stakeholders to deepen understanding of whether, how and why these initiatives worked.

Additionally, select interviews with key stakeholders, GSMA staff, donor representatives and climate experts complemented research on specific initiatives. These provided a broader perspective on the nature and scope of GSMA's climate portfolio and organisational aspects that influenced outcomes (EQ2.5). Observation and participation in a boot camp by one of the evaluation team opened up opportunities for informal conversations.

Content analysis from interview notes and the analysis of initiatives informed the development of a database of initiative highlights (Annexe 9). These highlights informed (and are cross-referenced in) the case studies as well as the rest of the evaluation report.

²¹ This mapping is included as a link to an external spreadsheet because it is too large to include in this report as an annexe.

Challenges and limitations

As anticipated, it was hard to map the portfolio comprehensively at the start of the evaluation. This influenced both our approach and sample. We could not identify all the initiatives contributing to the climate portfolio and relevant monitoring data, much of which was being published through internal monitoring and analysis processes in parallel with this evaluation. This made both portfolio mapping and in-country research challenging, particularly for the in-country evaluation teams. As there is neither a climate action nor other M4D or M4H strategy at country level, no one GSMA staff member had sight of all the initiatives or monitoring data. This meant it was not possible to provide the country researchers with clear ToR on initiatives, key respondents and gaps to explore during interviews. They had to be extremely flexible, and it was difficult for them to plan the work around other commitments, particularly given the long Christmas break (4–6 weeks) in Kenya.

GSMA also had some concerns about sensitivity, which prevented the evaluation team speaking to some key actors such as development partners (GIZ and the United Nations Development Programme (UNDP)) and some external partners. This posed further challenges for data triangulation. These actors are very likely to have useful insights on the EQs, and it is unusual not to be able to access their perspectives in publicly funded programmes.

A note on methods: In our inception report, we mentioned using a realist-inspired lens (not a full realist methodology). We used that lens lightly in our content analysis and considerations of whether, how and why GSMA M4D's climate action delivery model works to achieve the desired outcomes (EQ2.4 and EQ2.5). However, it was not used explicitly. Therefore, we have hardly mentioned realist concepts in the main body of the report, which is intended for a non-evaluator audience.

Some initiatives implemented at the start of the strategy period, 2020, particularly under M4H, were only identified fairly late in the evaluation. Despite this, by the endpoint, we had spoken to a sample of 64 individuals in interviews, focus group discussions, as well as casual conversations (Annexe 2) and reviewed the documents listed in Annexe 1.

Analysis bias and approach to triangulation: Some factors limited our ability to fully triangulate key data points: the formative scope of the evaluation; the nascent nature of some initiatives; GSMA's concerns about the quality of some grantee reports; and difficulties engaging external stakeholders. As a result, we were unable to confidently verify GSMA's contributions to the few outcomes identified at the level of individual initiatives. For this reason, we consider that the overall quality of evidence on GSMA contributions to outcomes and impacts relating to any single initiative is low, unless explicitly expressed otherwise in findings on EQ2.3, Section 3.2.3.

Instead, we sought to draw conclusions at the level of theme/team clusters (EQ2.3). This conservative approach is more consistent with the aims of a formative evaluation. Critical reflections from different staff, including those made during presentations and in draft reports, meant we were better able to triangulate insights on the overall quality of GSMA M4D climate action outputs (EQ2.1), relevance, and the effectiveness of broad approaches to the main outcomes (EQ2.4 and EQ2.5). Even though the sample was biased in terms of reliance on internal stakeholders, the critical perspectives that were shared mitigated significant bias in the findings. Therefore, we consider the evidence supporting outcome-level analysis to be relatively strong, and reinforced by triangulation with reference to the literature (EQ3). Overall, we are confident that our combined use of literature review evidence, secondary documentation, analysis of discussions with and feedback from diverse partners and staff, observation of a boot camp convened by GSMA, and select interviews with external stakeholders from government or donor agencies provides an adequate evidence base for the broad conclusions and recommendations that were the purpose of the formative evaluation.

Ethical principles outlined in this evaluation's Inception and Evaluability Assessment Report²² were followed. There were no safeguarding, data management or governance issues.

2.2.3 EQ3: The core team worked together to develop the concluding analysis, which brought together findings from EQ1 and EQ2 in conversation with GSMA M4D staff

An assessment of GSMA's problem analysis and the key assumptions underpinning its theory of change, as well as the evidence from the literature review summarised in EQ1, was used to further interpret findings from EQ2. This helped to explain how, why and to what extent GSMA's outputs were likely to contribute to the expected outcomes. The analysis also informed reflections on GSMA's niche, identified opportunities to enhance its strategic impact, and supported the development of actionable recommendations to advance GSMA M4D's Climate Action ambitions.

Staff from the M4D MEL team mainly drove the approach to answering and reporting on EQ3. They requested that we used findings from EQ1 and EQ2 to draw conclusions on the conditions and approaches under which climate change outcomes are most likely to be achieved, in order to inform decisions on future strategy. Since GSMA M4D saw EQ3 as the most important formative evaluation question, our conclusions on the appropriateness of the current use case, GSMA's potential niche, and opportunities to improve strategic actions comprise a substantial portion of the Findings section (see sections 3.3.2 and 3.3.3).

Challenges and limitations

An initial challenge was that GSMA did not have a ToC for its full M4D climate portfolio. It did have a ToC for the Climate Tech programme (a significant part of the portfolio) and an M4D Climate Impact Narrative (see Figure 1), which included key elements of a ToC. However, the latter was meant to summarise GSMA's thinking and approach, rather than explain assumed causality, and lacked explicit assumptions. The evaluation team developed a proposed set of assumptions based on the Impact Narrative and Climate Tech ToC, which were discussed and refined with GSMA staff.

A second challenge related to the GSMA team taking a strong interest in the content of findings for EQ3, requiring concrete examples and potential scenarios based on the analysis, findings and conclusions (Annexes 10 and 13). To a certain extent, this involved going beyond the specific framing of the sub-EQs. This resulted in significant additional analysis and content, which then needed to be adapted into the EQ framework.

²² Our formative evaluation was be informed by ethical principles and standards outlined in [a DFID guidance published in 2019](#). The key principles are to seek to maximise benefit and minimise harm; respect people's rights and dignity; act with honesty, competence and accountability; and deliver work of integrity and merit.

3. Findings

3.1 EQ1: Establishing an evidence-based theory of change

In this subsection we discuss findings from the [evidence gap map \(EGM\)](#) and [literature review](#) that explored an overarching sub-question, which was more precise and a slight reformulation of the main EQ: *According to the wider evidence base, how, and under what conditions do digital technologies contribute to climate change mitigation, adaptation, resilience, sustainable natural resource management (NRM) and environmental sustainability?*

EQ1 headline finding: Digital technologies have most impact when they are part of a broader, holistic strategy that seeks to understand, navigate and shift the systems (including institutions, relationships and governance) that reinforce climate vulnerability and constrain climate mitigation and sustainable NRM. The empirical evidence base on the role of mobile digital technologies for climate action is limited and uneven. The existing evidence suggests that mobile technology can play an important role in information provision and communication that incrementally strengthens individuals' anticipatory and absorptive adaptation capacities. However, numerous contextual factors (from programme design to people's resources and capacities) significantly affect access to, uptake and impact of mobile digital technologies.

The evaluation team addressed EQ1 in two stages. First, we gathered and assessed the empirical evidence on the use of digital technologies for climate action. We then reviewed the wider evidence for effective climate action. We discuss findings for each of these two stages in turn below. We conclude by outlining conditions for more effective approaches to leveraging mobile digital technology for climate action.

3.1.1 Empirical evidence for the efficiency of mobile digital technologies

Mobile digital technologies support climate adaptation, primarily by providing information that enhances the anticipatory and absorptive capacities of individuals and households.²³

Although there is strong evidence of mobile digital technology improving access to climate-related information and some evidence of communication aiding adaptation, there is little evidence that digital tech has strengthened collective adaptive capacities or overall resilience of communities or systems.²⁴

Outside the domain of climate change adaptation, mobile and digital technologies can enhance sustainable NRM and climate finance. They do this by improving transparency, monitoring and accountability; direct payments in carbon markets; and payment for ecosystem services (including but not limited to sustainable forest management).²⁵ Although scholarly evidence on mobile tech in sustainable NRM and climate finance is still emerging, studies suggest it can play an important role in engaging communities in monitoring ecosystems, NRM programmes and funding flows. However, the extent to which it can fulfil this role effectively depends on various individual, community and institutional factors (see below).

²³ Evidence emerging from the EGM.

²⁴ Literature review pp. 13–20.

²⁵ Literature review p. 22–24, 27.

Box 1: Three broad sets of conditions that affect the use and impact of mobile digital tech in climate action

1. Structural and technological factors:

- Mobile digital infrastructure and service
- Access to smart mobile devices
- Appropriateness and functionality of technology

2. Social, economic and political factors:

- Governance frameworks
- Institutional capacity
- Political economy
- Trust and collaboration
- Power and social dynamics that shape vulnerabilities (e.g. gender norms)

3. Behaviour, capacity and motivation:

- Awareness and capacity of users (e.g. digital literacy)
- Education, gender, age, income, livelihood, etc.
- Other individual perspectives, considerations and circumstances

Various factors influence the use and impact of mobile digital technologies to address climate vulnerability and strengthen adaptive capacity, particularly for vulnerable groups.

The EGM suggests three broad sets of conditions (see Box 1). These complex factors must be taken into account in the design and implementation of programmes and approaches to leveraging mobile digital technology to advance climate change outcomes.

3.1.2 Broader evidence on successful climate initiatives

Evidence suggests that under certain conditions, broader climate interventions (that do not explicitly utilise mobile digital technologies) can help reduce vulnerabilities, but they can also have negative impacts. Some interventions unintentionally make things worse.²⁶ Reasons include weak understanding of the context (in terms of vulnerability to climate change) and a lack of community participation in programme design.

Successful initiatives take into account the systems that underpin climate vulnerability (whether of individuals, groups or communities), and enable or constrain effective mitigation and sustainable NRM. This includes governance factors related to institutional dynamics and relationships among actors, particularly the challenges of unequal power relations and other structural constraints.

Effective climate adaptation and resilience requires understanding and shifting interrelated systems of actors, institutions and governance. Resilience emerges where robust systems and supportive institutions enable effective responses.²⁷ However, many climate adaptation efforts are relatively narrowly focused and overlook power dynamics, which undermines their inclusiveness, effectiveness and/or sustainability. In NRM, tensions between political economy and collective action highlight the need for inclusive governance. There are barriers to collective action for NRM in nearly all contexts, but institutions and governance frameworks can do much to foster trust, participation and accountability. This in turn can enable inclusive, effective and sustainable NRM and climate resilience.

²⁶ [Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? - ScienceDirect](#)

²⁷ Literature review pp. 9–11, 29.

Thus, the key factors and conditions for effective climate action and outcomes are the systems – actors, relationships, rules, resources, etc. – that shape decisions, behaviours, interactions and vulnerabilities for a given population in a particular context. These factors are both formal and informal. They include political economy incentives and power dynamics that are often among the root causes of vulnerability, as well as the failure to advance climate change mitigation and sustainable NRM.

3.1.3 Enabling effective climate change mitigation, adaptation, resilience, NRM and environmental sustainability: concluding comments

Leveraging mobile digital technologies for climate action requires an holistic approach that understands, navigates and shifts the systems that reinforce vulnerability and/or constrain climate mitigation and sustainable NRM. This approach entails four mutually reinforcing components:²⁸

- **Analysis and understanding of the root causes of climate vulnerability and barriers to climate action, particularly political economy and power dynamics, and the broader systems shaping climate outcomes.** The evidence from research and practice highlights the need for more nuanced, contextual and systemic approaches to climate action – approaches that recognise the complex root causes, consequences, enablers and constraints of climate challenges, actions and outcomes. A clear implication is the need for more analysis and learning to inform policies, practices and strategies, including those related to mobile digital technologies. This could include a multidimensional assessment of the climate vulnerability of different groups (including power asymmetries, gender dynamics and other root causes).
- **Mobile digital technologies should be explored and leveraged through holistic and multidimensional ecosystems approaches and partnerships to contribute to improved climate outcomes.** The evidence generally suggests that isolated, narrow and/or top-down approaches are less likely to be successful or sustainable, and may even have negative unintended consequences, including maladaptation. Effective activities share key traits: collaborative decision-making; resource-sharing; and approaches that enhance wellbeing, institutions, and environmental security. They are synergistic, not effective in isolation, and address both root causes and impacts of climate risk.

Individual technology solutions are generally associated with modest incremental (though positive) shifts in climate outcomes, although as stated earlier these depend on various enabling factors. As climate vulnerabilities and impacts are multidimensional and systemic, effective climate action must account for their diverse and interconnected drivers.

- **Inclusive, participatory, collaborative and locally led engagement and processes for climate action.** There is broad consensus about the need for more inclusive and meaningful participation of people affected by climate change, particularly the most vulnerable groups. This goes beyond one-off consultations or information-sharing, to institutionalising spaces, platforms, coalitions and/or cooperative citizen organisations. This is the most effective way to meaningfully engage and inform locally led decisions, and to strengthen implementation of climate action across the policy and/or project cycle. The benefits of inclusive and participatory approaches are many. They include: leveraging diverse perspectives and context-specific knowledge; strengthening relationships and trust among diverse stakeholders; balancing the influence of powerful actors; improving policy and technology design to achieve relevant objectives; and giving decisions and decision-makers more credibility and legitimacy. Given the realities of whether and how people from marginalised and vulnerable groups or communities can engage with climate action, approaches should

²⁸ Literature review pp. 31–33.

ensure inclusion and connect local engagement to higher-level decisions (including through representative civic actors such as associations or federations).

- **Understanding and engaging with institutions and governance of climate actions, particularly transparency and accountability of decision-making, implementation and reporting.** Institutional dynamics (formal laws and regulations as well as informal norms and practices) significantly enable or constrain effective climate action, including those involving mobile digital technologies. Governance arrangements shaping interactions among actors are important factors in the success or failure of climate actions. For example, transparency and accountability in decision-making and implementation (including reporting on progress and evaluating impacts) plays a major part in making processes more credible and outcomes more effective. Evidence suggests that promising approaches for leveraging digital technology involve: enabling collective action by local people, particularly marginalised groups; empowering people with information, connections and legitimacy; and creating spaces for people and decision-makers to engage with each other.

3.2 EQ2: Testing the GSMA M4D climate tech ‘use case’ or theory of action

In this subsection we summarise findings relating to EQ2: *how, why and to what extent is GSMA’s M4D climate approach likely to have anticipated impacts in areas of climate change mitigation, adaptation, resilience and natural resource management and environment for target populations?*

EQ2 headline finding: GSMA’s innovation approach to climate action is likely to lead to moderate, context-dependent impacts, with stronger potential when aligned with commercial incentives of key stakeholders and government priorities. GSMA’s approach to climate action and mobile tech innovation is relevant and effective in engaging key stakeholders. However, they face common structural, technical, political, economic, social and behavioural challenges. These conditions, as well as various organisational constraints, particularly the absence of country strategies, make it challenging to contribute to climate change mitigation, adaptation, resilience, natural resource management and environmental sustainability benefiting target populations at scale.

Most elements of the approach described in the impact narrative have been tested. However, as might be expected in a formative evaluation there has been more focus on enhancing household resilience and improving digital utility access than on GSMA’s newer ambitions regarding climate finance and NRM. With this in mind, evidence indicates that the innovation approach is largely functioning as intended. GSMA’s catalytic funding, technical support and convening power (particularly in collaboration with MNOs) effectively align the commercial incentives of MNOs, start-ups and financial institutions with climate objectives. GSMA-supported initiatives have also heightened government awareness of the potential of climate tech and fostered greater willingness to experiment and learn. Notably, there are emerging examples where technology is enabling carbon markets, with important implications for climate finance transactions in the future. Furthermore, use cases involving Internet of Things-based climate and agriculture advisory services and SMART emissions-reducing technologies demonstrate how mobile technology can help mitigate emissions, enhance both absorptive and anticipatory resilience of select populations as well as NRM. While this is encouraging (and increasingly integrating artificial intelligence), GSMA’s experience shows that there remain risks of overestimating technology’s potential. Although simple technological features perform well, ensuring tech solutions are accessible, useful, usable and able to play a role in meaningful adaptation with significant impacts for diverse populations at scale remains challenging.

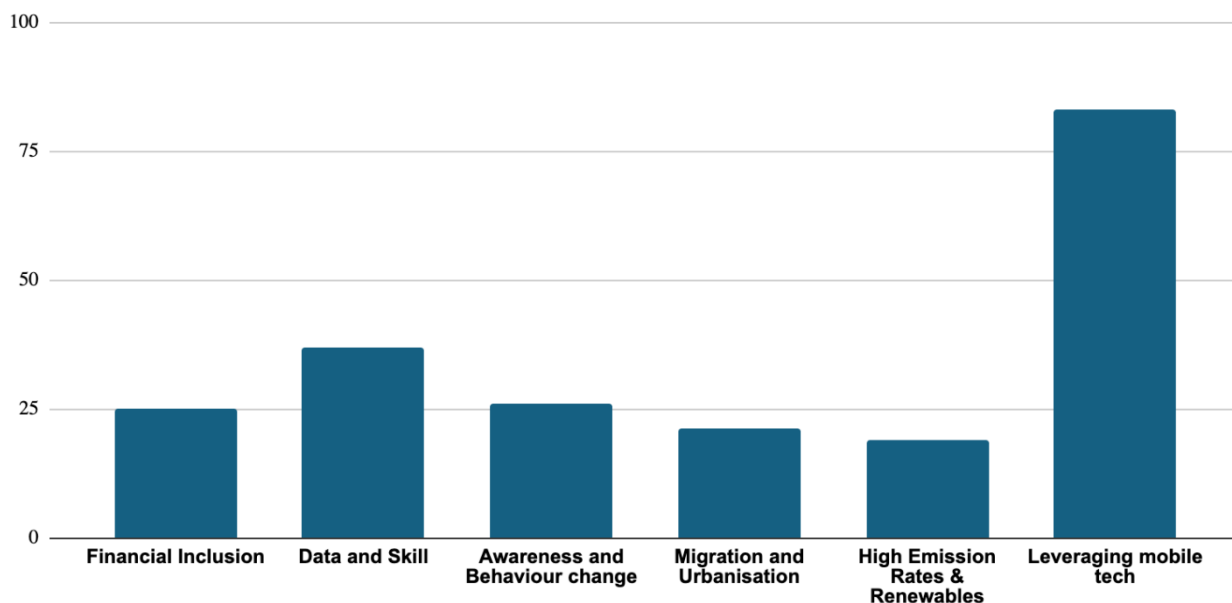
3.2.1 What is the extent of implementation and quality of outputs being achieved?

Here, we begin by outlining findings from our mapping of M4D initiatives, then look at the quality of outputs under each activity area: insights; innovation; partnerships; and capacity-building. The evaluation team used a mix of stakeholder perceptions and analysis of insight reports as the main data sources for this question. Key findings for each activity area are reasonably well triangulated in terms of shared views among a range of stakeholders.

EQ2.1 headline finding: There are many initiatives across all problem areas defined in GSMA’s Impact Narrative, with most focusing on strengthening household resilience and improving access to digital utility services. Partners and grantees generally consider GSMA’s insight reports, Innovation Fund grants, capacity-building, and convening efforts to be strong. However, there were questions about how useful and relevant some insight reports are.

Since 2019, GSMA M4D has supported more than 90 climate-related initiatives in over 17 countries. The most significant footprints (measured by number of activities) are in Pakistan, Kenya, Nigeria, Indonesia and Nepal.²⁹ GSMA is implementing multiple initiatives across all problem areas defined in the Climate Impact Narrative (see Figure 3). Individual initiatives often relate to multiple problem areas. Almost all relate to the ‘catch all’ problem of leveraging mobile technologies.

Figure 3: Number of GSMA activities targeting problem areas defined in the Climate Impact Narrative

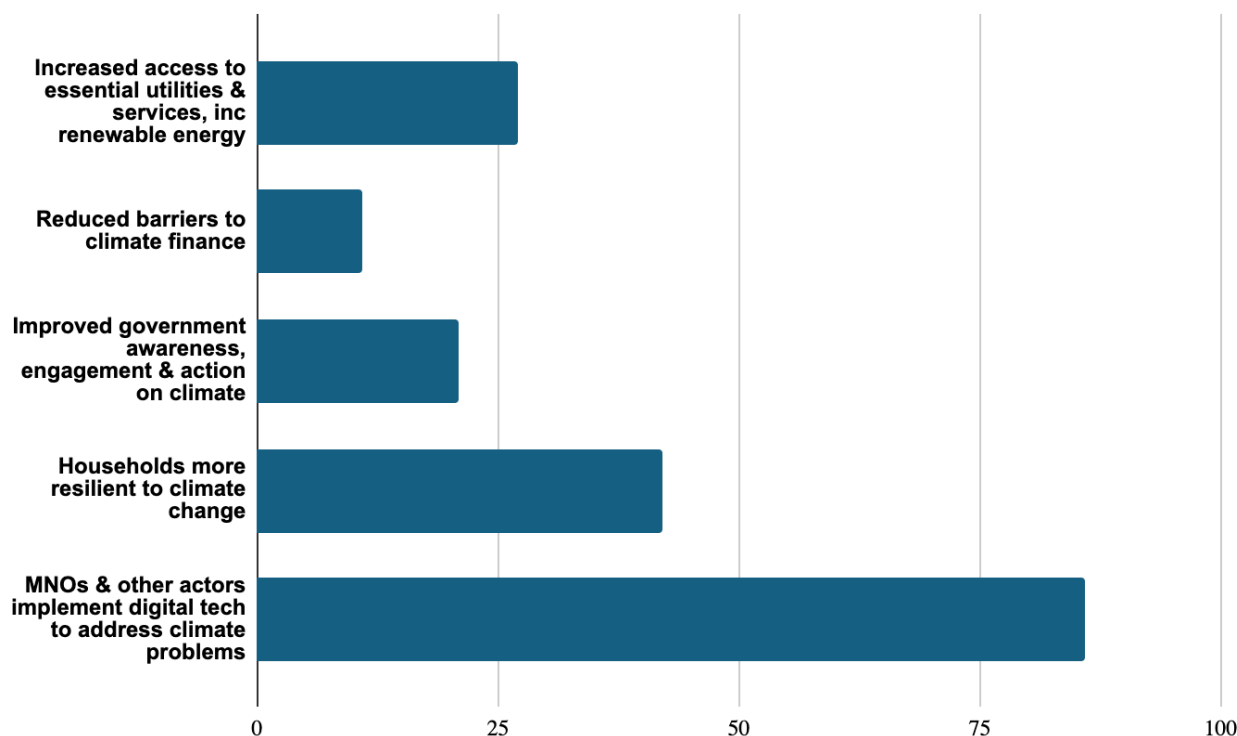


Source: Evaluation team (analysis of portfolio mapping).

Some initiatives are designed to contribute to each intended outcome area; and individual initiatives can relate to multiple outcome areas. More initiatives contribute to household resilience and increased access to digital utility services, than to climate finance and government awareness (see Figure 4). However, almost all contribute to what seems to be an intermediate outcome: ‘MNOs, governments, tech industry (including GSMA Innovation Fund grantees), investors, and humanitarian and development organisations develop and implement digital technology and services to better address climate problems and support communities to anticipate, adapt, absorb and mitigate climate shocks.’

Figure 4: Number of GSMA activities that intend to contribute to outcomes defined in the Climate Impact Narrative

²⁹ The evaluation team mapped GSMA M4D’s grants, events and activities, drawing on information from GSMA programme documentation (annual reviews, programme management material), the GSMA website, and conversations with and guidance from GSMA staff. The aim was to provide a reasonably representative (though not exhaustive) picture of GSMA’s climate-related work since 2020. GSMA’s substantial work on Digital Inclusion and Digital Public Infrastructure was not included; although relevant to climate, these did not fit within GSMA’s scope for this evaluation. See GSMAPortfolioMappingTool-final.xlsx



Source: Evaluation team (analysis of portfolio mapping).

Insight reports elaborating how mobile technology can contribute to mitigation, adaptation and resilience are valued by various stakeholders. They are assessed to be good quality, though feedback on how useful they are is mixed. GSMA’s climate-related insight reports are generally seen as good quality, credible and timely,³⁰ often showcasing grantee or partner use cases and highlighting GSMA’s thought leadership.³¹ They address diverse themes, including climate finance, digital inclusion and humanitarian access. Themes are driven by GSMA analysis, partner needs or FCDO requests.³² This evaluation analysed a sample of insight reports, judging 8 of the 10 reports reviewed as good quality (Annexe 11), echoing feedback from key informant interviews.

Some stakeholders value the insight reports for the legitimacy they lend to convening, and for their contribution to broader climate and development discourse.³³ Others feel they lack contextual depth and actionable guidance.³⁴

The flagship reports are primarily used for GSMA’s own advocacy and convening, with limited evidence of broader uptake. Online engagement is generally low – for example, one report on NRM received just 25 downloads in a year.³⁵ However, there seems greater potential for engagement and

³⁰ Comments on quality were made in KIIs with 3 donors; 1 partner and the FCDO 2024 AR and M4H donor KPI reporting spreadsheets.

³¹ FCDO M4D 2024 Annual Review; FCDO M4D 2023 Annual Review.

³² GSMA Staff KIIs. Donor KIIs.

³³ KII with Partner; KII with GSMA Staff.

³⁴ KIIs with 2 Partners and 3 GSMA Staff.

³⁵ Although there are challenges and limitations in web usage statistics, they do provide some indication of the extent to which reports are accessed. The Insight report, [Exploring barriers and incentives to digital solutions in natural resource management](#) landing page has been visited only 193 times, and the report downloaded 25 times since it was published in 2023. Based on the limited data shared with the team, this report represents the median in terms of usage.

influence with stakeholders when reports are produced using more participatory approaches, such as those used in Pakistan (AI Forest Fires) and Indonesia (Mangrove Mapping).³⁶

The Innovation Fund is widely seen as effective in supporting tech innovation and partnerships, enabling start-ups to test potential climate solutions. However, the climate objectives sometimes become secondary to commercial goals. GSMA supports and funds innovative solutions primarily through its central Innovation Fund. This uses an open-call approach, with funding rounds that have covered broad topics such as Climate Resilience and Adaptation (twice); Anticipatory Humanitarian Action; and Digital Urban Services.³⁷ These rounds are open to countries eligible for ODA.³⁸ These four climate-related calls were considered successful, receiving more than 1,500 applications, and resulting in grants to 42 organisations in 18 countries.³⁹ Grants have spanned innovations ranging from the nature of the technology (which usually includes a ‘feature’ that generates information and then provides a service and channel for distribution)⁴⁰ to the business model. It can also include the relationships between actors involved to enable the tech to have impact at scale.

Grantees value the Innovation Fund overall,⁴¹ though some reported challenges around complex application and reporting processes,⁴² generic technical assistance,⁴³ and limited budget flexibility, especially in volatile economic contexts (see Section 3.2.5).⁴⁴ Nonetheless, the Fund is widely recognised by start-ups, investors and experts as a valuable mechanism for early-stage climate innovation.⁴⁵

Although most grantee projects had positive climate objectives, the extent to which these were prioritised varied.⁴⁶ Some grantees shifted the focus toward commercial sustainability, particularly when scaling proves challenging.⁴⁷ This focus can dilute climate objectives over time.⁴⁸

GSMA’s strategic approach to convening partnerships between MNOs and other actors is highly valued by grantees, donors, MNOs and external experts. It has successfully brokered and nurtured partnership clusters in key areas. Examples include waste management and circularity (e.g. Kenya, Africa region); early warning systems (e.g. Pakistan and globally); and water, with actors including the International Water Association, the World Bank, Wonderkid (former grantee), and Imagine H2O.⁴⁹

³⁶ Rather than GSMA producing the report and then looking to influence stakeholders, the process for production of the “[Combating forest fires with AI in Pakistan](#)” and “[Mapping resilience: Participatory digital mapping for mangrove conservation](#)” reports involved a process by which key stakeholders were engaged in participatory process which helped to shape and provide content for the report. Similar in principle to how the Institute of Development Studies term [Engaged Excellence](#).

³⁷ Altai Round 6 Portfolio Review.

³⁸ [OECD DAC eligible countries](#)

³⁹ Figures compiled from GSMA M4D and M4H Donor Reporting; The GSMA Innovation Fund for Digital Urban Services: Portfolio overview. The GSMA Innovation Fund for Climate Resilience and Adaptation Cohort 2.0 announcement; The GSMA Innovation Fund for Climate Resilience and Adaptation: Portfolio overview; and Announcing the GSMA Innovation Fund for Anticipatory Humanitarian Action Cohort.

⁴⁰ GSMA Emerging Trends in Climate Tech Innovations: The GSMA Innovation Fund for Climate Resilience and Adaptation. 2023. The GSMA Innovation Fund for Digital Urban Services: Portfolio overview. The GSMA Innovation Fund for Climate Resilience and Adaptation Cohort 2.0 announcement; The GSMA Innovation Fund for Climate Resilience and Adaptation: Portfolio overview; and Announcing the GSMA Innovation Fund for Anticipatory Humanitarian Action Cohort.

⁴¹ Grantee KIIs; The GSMA Innovation Fund Process Evaluation Final Report, Picture Impact, May 2023.

⁴² Grantee KIIs; GSMA Staff KIIs; The GSMA Innovation Fund Process Evaluation Final Report, Picture Impact, May 2023.

⁴³ The GSMA Innovation Fund Process Evaluation Final Report, Picture Impact, May 2023. 3 Grantee KIIs.

⁴⁴ Grantee KIIs and casual conversations with current and former grantees.

⁴⁵ KIIs with 4 Innovation Fund grantees; Casual Conversation with Investor at GSMA Nairobi Bootcamp; Aquarech final reporting; informal conversations with other Grantees. Innovation Fund Evaluation report, [ODI working paper](#)

⁴⁶ This point was raised by GSMA staff in casual conversations at the Kenya boot camp.

⁴⁷ Casual conversations with GSMA Staff.

⁴⁸ Casual conversations with GSMA Staff.

⁴⁹ KIIs with 3 grantees; 2 partners; 5 GSMA staff. FCDO Annual Review 2024. FCDO Annual Review 2023.

These relationships are often difficult for individual actors to establish alone, and the partnerships that have developed have contributed to GSMA's growing reputation as a thought leader.⁵⁰ Its influence is expanding through participation in global forums, including a recurring seat on the International Water Association's steering committee and collaboration with World Water Week on the 'digital for water' agenda. In 2024, the M4D Climate Tech Team presented findings from *Nature tech nexus: bridging biodiversity and business*, at the Convention on Biological Diversity, reflecting GSMA's increasing visibility in global climate and sustainability discussions.⁵¹

Capacity-building activities (through the Innovation Fund grants and partnerships that have developed) are well received and appreciated. Grantees greatly appreciate GSMA's support in a number of key areas: grant management and financial capacities;⁵² strengthening business models; framing and pitching businesses to investors;⁵³ understanding how best to engage and develop strategic partnerships with MNOs;⁵⁴ the use of USSD to reach non-smartphone users; understanding intended users and customers;⁵⁵ and more nuanced thinking around adaptation and resilience, and how to access climate finance.⁵⁶ The efficacy of grantee and partner initiatives to strengthen capacity and digital literacy of citizen/business and government users is covered in Section 3.2.3, on effectiveness.

3.2.2 Are GSMA's initiatives and that of its partners environmentally sustainable?

In this section we present our findings related to the environmental sustainability of GSMA and their partners' initiatives. The evaluation team's analysis is largely based on interviews with GSMA's MEL staff and review of the outputs of GSMA's attempts to assess environmental sustainability.

EQ2.2 headline finding: There is no strong evidence on whether initiatives by GSMA M4D and its partners are environmentally sustainable because the methods used to assess this have proved complex. GSMA is exploring what is realistic for grantees and what represents good value for money.

GSMA's experiments with different approaches to assessing the environmental sustainability of grantee projects have generated valuable learning on what is required and what represents good value for money. Over the past five years, GSMA M4D has explored various approaches to supporting partners with environmental, social and economic impact assessments.⁵⁷ Although early pilots using remote methods produced quality reports, a donor field visit revealed that environmental assessments require on-site visits.⁵⁸ In response, GSMA Monitoring, Evaluation and Learning (MEL) team staff developed a new, more robust approach that clearly outlines what is required of partners. GSMA recognises that imposing such assessments on start-ups may be unrealistic and risk poor value for money.⁵⁹ Some grantees are beginning to explore ways to measure impact that include environmental and carbon emissions.⁶⁰ Incentives such as access to carbon markets may encourage wider uptake and experimentation with artificial

⁵⁰ FCDO Annual Review 2024. KII with a Partner; 3 GSMA staff.

⁵¹ Email: COP16 - The download.eml

⁵² KII 4 Innovation Fund Grantees; 1 KII Investor. The GSMA Innovation Fund Process Evaluation Final Report, Picture Impact, May 2023. Casual conversations with 4 grantees.

⁵³ KIIs with 6 Innovation Grantees.

⁵⁴ KII Partner; Casual conversations with Innovation Grantees at Kenya Bootcamp; KII Grantee.

⁵⁵ KII Grantee; Casual conversations with participants at Nairobi boot camp February 2025.

⁵⁶ Observation at Nairobi boot camp Feb 2025; KII with GSMA staff; KII with Partner; KIIs with 2 Grantees.

⁵⁷ KII GSMA staff; our review of the Aquarech Environmental Assessment Report. GSMA blog: [Five steps to measuring environmental impact of climate tech innovation](#)

⁵⁸ KII GSMA Staff.

⁵⁹ GSMA KII Staff.

⁶⁰ Pakistan case study (Annexe 7).

intelligence (AI).⁶¹ However, GSMA has learnt that rigorous and transparent methods of assessing environmental sustainability are essential to ensure integrity.⁶²

The evaluation team was not able to find a GSMA internal policy on environmental sustainability. However, staff noted that teams do not attend international events and contribute to emissions through air travel unless they have been invited and can see a strategic benefit.⁶³

3.2.3 Are the types of interventions supported by GSMA effective?

In this subsection we consider evidence related to EQ2.3. *Are interventions effective? To what extent have activities and outputs under EQ2.1 contributed to outcomes? To what extent do these outcomes map on to those outlined in GSMA’s Climate Impact Narrative?*

The findings presented here are informed by a mapping of emerging outcomes from initiatives outlined in EQ2.1 onto outcomes outlined in the GSMA M4D and M4H Climate Impact Narrative that represent implicit use cases (see the Introduction, Section 1, and Figure 1). In view of methodological challenges outlined in the inception report and because some outcome areas are nascent, the evaluation team have had to be opportunist and make the most of the data we have. This subsection therefore summarises a sample of evidence from secondary and primary data on a set of outcomes we were able to identify. We start by discussing what we see as ‘intermediary outcomes’ on climate finance, engaging government actors and other stakeholders GSMA convenes to develop and implement digital tech for climate action. We then move on to discuss outcomes relating to specific impact areas: climate change mitigation through reducing emissions; building resilience capacities; and enhancing NRM and environmental sustainability. Table 2 describes our approach to mapping.

Table 2: Evaluation team’s approach to mapping of outcomes

GSMA Climate Impact Narrative	Our interpretation
MNOs, governments, tech industry (including GSMA Innovation Fund grantees), investors, humanitarian and development organisations develop and implement digital technology and services to better address climate problems and support communities to anticipate, adapt, absorb and mitigate climate shocks.	1. This is an intermediate outcome that enables access to utilities as well as household resilience, environmental sustainability and NRM. It is therefore considered first.
Improved government awareness , engagement and support for climate action initiatives, including environmental sustainability.	2. This is an intermediate outcome that enables access to utilities as well as household resilience, environmental sustainability and NRM.
Reduced barriers to climate finance as a result of improved awareness and support for climate finance policies among key stakeholders, including government, investors, donors, MNOs, mobile money providers, NRM, financial service providers, innovators and the tech sector.	3. This is an intermediate outcome that enables access to utilities as well as household resilience, environmental sustainability and NRM.
Increased access to essential and sustainable utilities and services, including renewable energy , through digital solutions.	4. This a ‘final outcome’ as it implies benefits at individual, household or community level and aligns with the Climate Tech theory of change (ToC).

⁶¹ KII Grantee.

⁶² KII GSMA Staff.

⁶³ FGD GSMA.

<p>Households, including farmers, women and marginalised groups, are more resilient to climate change and shocks through access to climate information and inputs and affordable financial services.</p>	<p>5. This a ‘final outcome’ as it implies benefits at individual, household or community level and aligns with the Climate Tech ToC.</p>
<p>Enhanced NRM and environmental sustainability.</p>	<p>6. This a final and missing outcome as it implies benefits to nature and natural resources as well as people and communities, and aligns with the Climate Tech ToC.</p>

This subsection draws on evidence collated in the outcomes analysis (Annexe 9), where all secondary and primary sources can be found.

EQ2.3 headline finding: GSMA has made strong progress on intermediary outcomes by convening and engaging MNOs, start-ups, government actors, civil society organisations (CSOs) and investors to test and scale digital climate solutions. However, the subsequent outcomes of these actions are mixed. There has been valuable learning in technology applications for carbon and environmental service payment schemes, supporting GSMA’s goal of unlocking climate finance. Yet, emerging evidence on GSMA-supported contributions to more significant outcomes and impacts varies. Use cases that illustrate SMART technology contributions to essential and sustainable utilities and services (including renewable energy) and resilience (e.g. IoT and mobile climate and agricultural advisory services) show promise. They can reduce emissions and enhance both absorptive and anticipatory capacities at household level, with a few examples achieving scale. Yet these capacities do not always involve meaningful adaptations or address extreme vulnerabilities caused by climate and environmental hazards. Moreover, the potential for broader, community-wide impact is more evident in humanitarian initiatives that offer opportunities to strengthen the absorptive capacity of larger at-risk populations. Evidence on contributions to sustainable NRM is more nascent.

1. There is strong evidence that GSMA has encouraged mobile network operators (MNOs) and investors to collaborate with GSMA grantees, governments and humanitarian actors to pilot mobile tech for climate action at scale. Although the extent to which GSMA M4D plays a direct role in securing these relationships and investments varies, it has clearly contributed to connections and credibility that support climate tech innovation. GSMA has brokered relationships that would have been difficult or slow to establish independently. As a result, across multiple countries, GSMA grantees have secured significant partnerships and funding to develop and scale solutions, with GSMA often playing a catalytic role. Although investor motives around climate outcomes remain uncertain, GSMA’s influence in brokering relationships has demonstrably advanced its climate action agenda.

Several grantees and other GSMA partners have built or deepened partnerships with major MNOs that help them advance goals and or achieve scale and commercial viability. In Kenya, for example, Safaricom signed a memorandum of understanding (MoU) with Taka Ni Mali to advance the use of SMART bins for urban waste management. In Pakistan BaKhabar Kissan (BKK) attributed strategic relationships with Jazz and Zong to achieving scale, and sharing climate information and or agricultural advice with large numbers of farmers in isolated rural areas. In some instances, where there was no clear business case or commercial incentive for MNOs, GSMA was able to leverage MNO commitments on corporate social responsibility (CSR) and/or find alternative sources of funding. Examples include GSMA Mutual (which is not part of GSMA M4D) using the Universal

Service Fund (USF)⁶⁴ to encourage MNOs in Pakistan to participate in the Smart Villages programme – Box 2.

Box 2: Smart Villages Pakistan: GSMA engages Jazz's support

In April 2021, Pakistan's Universal Service Fund (USF), in collaboration with Huawei and the International Telecommunication Union (ITU), launched the Smart Village project to digitise urban utilities.

Following introductory meetings in September 2021, the GSMA Digital Utilities team joined the initiative, offering expertise on digital inclusion to the Pakistan government and other stakeholders, including Jazz, a mobile network operator (MNO) and GSMA partner.

In November 2021, GSMA, USF, and Jazz co-hosted a workshop as part of GSMA's standard approach to fostering supportive mobile ecosystems—engaging MNOs early to ensure they can support startups with connectivity as and where needed. During the workshop, Gokina (near Islamabad) was selected as the pilot site for digital inclusion efforts and a USF-funded competition then led to the selection of three pilot projects:

- **Ecofire** – clean cooking stoves
- **Pakistan Agricultural Research** – climate-smart agriculture
- **SBEEC (SB Electronics Engineering and Control Pvt Ltd)** – smart metering for energy efficiency

Although SBEEC's pilot showed promising results, political disruptions ultimately led to the suspension of all three initiatives, despite findings being shared with USF.

Another Pakistan example relates to multi-stakeholder early warning system (EWS) initiatives at national and subnational levels (Box 3).

Box 3: EW4All: GSMA supports Mobile Network Operators to play essential roles

GSMA plays a leading role in the UN EW4All (Early Warning for All) Initiative through its Mobile for Humanitarian Innovation (M4H) programme, as a member of its Pillar 3 (led by the International Telecommunication Union), on warning dissemination and communication. The GSMA Director General sits on the EW4All High-Level Advisory Panel. GSMA supports EW4All in all four activity areas of the GSMA Climate Impact Narrative:

- **Convening and partnerships:** Bringing together mobile industry and multi-sectoral partnerships to develop early warning systems (EWSs).
- **Investment:** Through the Innovation Fund, supporting innovative digital EWS solutions, including Synnefa (Kenya), Tahmo (Ghana), Komunidad (Philippines) and Buraq (Pakistan).
- **Research and knowledge-sharing:** Publishing studies on mobile-enabled EWSs, including cell broadcast technology and inclusive risk communication. Promoting best practices through GSMA's Mobile World Congress and M360 events.
- **Technical support:** Assisting mobile network operators and partners to develop user-focused EWSs.

Mobile networks are essential for risk communications, but effective early warning systems require better public-private partnerships and coordination mechanisms that are often missing. M4H organised three regional workshops in 2023 and 2024 across the Caribbean, Asia Pacific and Africa. These brought together diverse stakeholders to discuss the role of telecommunications in disaster preparedness, response, and recovery, with EWS as a key focus. The workshops operated under the [GSMA Humanitarian Connectivity Charter](#) – shared principles adopted by mobile industry actors to enhance partnership and coordination for emergency preparedness and response.

⁶⁴ Universal Service Funds have been established in many countries to support the extension of mobile service coverage by mobile operators into under-served areas in which there is not a commercial case.

The convenings have generated country-level coordination and development of EWSs. A notable example is the August 2024 Statement of Commitment signed between GSMA and MNO Jazz in Pakistan, committing to collaborate on developing and implementing mobile-enabled EWSs.

Although these are promising examples, there are cases where it is challenging to engage MNOs. For instance, Aquarech, a Kenyan grantee working on aquaculture, failed to forge a relationship with Safaricom.

2. There is strong evidence that GSMA and its grantees and partners have enabled government actors to explore how climate tech can deliver on their development, disaster management and climate priorities. Government partnerships with GSMA grantees have enabled testing and integration of digital solutions in areas such as water management (Wonderkid- Kenya), agriculture (Lersha - Ethiopia), natural resource management (World Vision -Kenya and government officers in Indonesia), disaster early warning systems (Komunidad- the Philippines, Forest Fire Management and other Early Warning in Pakistan) and waste management (Freetown Waste Management – Sierra Leone – Box 4).

Box 4: Freetown Waste Transformers (Sierra Leone): partnerships enable a waste-to-energy pilot for urban residents

Freetown Waste Transformers (FWT) aims to improve waste disposal management and at the same time enable access to clean and affordable energy. In 2021 they received a GSMA grant to tackle two pressing challenges in Sierra Leone's capital: inadequate waste management and limited access to clean, affordable energy. With 76% of Sierra Leone's population lacking electricity, many micro, small and medium enterprises (MSMEs) rely on polluting diesel generators. At the same time, only about 30% of Freetown's waste is safely disposed of, with the rest ending up in illegal dumpsites or the ocean.

The grant aimed to digitalise and improve waste collection by enabling FWT to develop the DortiBox mobile app—a GPS-enabled mapping and coordination tool and implement it in partnership with the Freetown City Council. DortiBox allows waste collectors to track, manage and report organic waste collection in real time, helping FWT secure the feedstock needed for its anaerobic biodigesters. These biodigesters convert organic waste into biogas for electricity generation, providing a sustainable alternative to diesel power. FWT also secured strategic partnerships to scale impact. Collaborations with Africell Sierra Leone and Orange Money Sierra Leone enabled mobile money integration within the DortiBox app, facilitating cashless transactions. Africell further became an energy offtaker, directly purchasing electricity generated by FWT units.

By the end of the project, FWT had launched the DortiBox app, onboarded over 350 users, and trained 322 waste collectors. The initiative benefited 46,552 residents through improved waste services, increased collector incomes, and clean energy provision from FWT's Aberdeen Women's Centre waste-to-energy site. Over the grant period, 11.85 tonnes of organic waste were diverted from landfills, producing 12,205 kWh of renewable electricity.

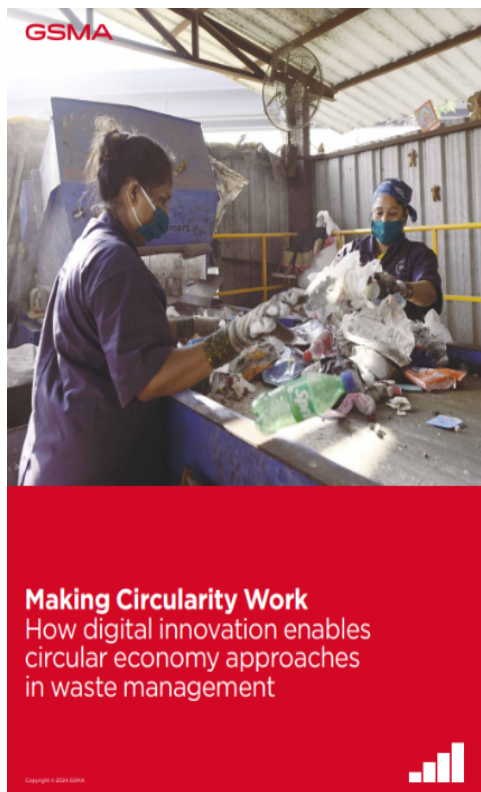
Freetown City Council engaged with Freetown Waste Transformers and endorsed their app as the approach contributed to achieving the City's waste management targets. They recently awarded FWT a contract.

For more information, on FWT see [Digitising waste collection: Freetown Waste Transformers' DortiBox app in Sierra Leone](#) and [Freetown Waste Transformers: A study of private sector innovation in the waste management sector in Africa](#) and [Freetown Waste Transformers \(FWT\) secures major waste collection concession from Freetown City Council | Mobile for Development](#)

GSMA has also played a catalytic role in leveraging experience of grantees such as FWT to convene discussions on the potential of large scale public–private partnerships for smart solutions to more efficient urban digital utilities.

Box 5: Influencing waste management ecosystems: GSMA’s innovation model in action

Emerging evidence suggests that GSMA is leveraging insights from micro-level smart technology use cases to convene multistakeholder discussions that could influence the broader adoption of emissions-reducing technologies in urban utilities and services.



GSMA’s climate tech innovation model features feedback loops that translate learning from pilot initiatives into sector-wide influence. A strong example of this is the 2024 report *Making Circularity Work*, which synthesised insights from start-ups such as ReCircle (India) and Freetown Waste Transformers (Sierra Leone) to explore how digital innovation can support circular economy strategies in waste management. Drawing on GSMA’s deepening understanding of global trends in waste and emissions reduction, the report directly informed the *Digital Urban Utilities multistakeholder meeting* in Nairobi, co-hosted by GSMA and its partner, the Kenya Alliance of Resident Associations (KARA). The event brought together municipal leaders, mobile network operators and start-ups (including Taka ni Mali, a key GSMA strategic partner in Kenya, which acknowledged the report’s role in convening a diverse group of stakeholders).

Relatedly, GSMA brokered and strengthened Taka ni Mali’s relationship with Safaricom and helped connect it with global partners such as the UN Global Compact. In turn, Taka ni Mali has helped GSMA raise awareness with the Kenyan government and others, bringing international learning into Kenya’s waste

sector and reinforcing GSMA’s influence on smart, emissions-reducing technologies in cities.

3. There is reasonable evidence that GSMA has supported valuable partner-led experiments demonstrating that IoT solutions can be powerful tools for improving climate finance traceability. However, there are potential issues around their use for NRM. ATEC’s real-time monitoring technology links carbon reductions from e-stoves in Bangladesh directly to carbon credit trades with European corporations, demonstrating how IoT can ensure transparency and accountability. ReCircle’s platform (in India) supports companies to comply with extended producer responsibility (EPR) regulations, strengthening systems for environmental governance. In Kenya, 4R Digital is helping Safaricom and the Ministry of Forestry build CaVEx (Carbon Value Exchange), a scalable platform to enable community forestry groups to sell carbon credits – a model with national potential. Interest in carbon market accreditation is growing among other partners and grantees across various countries, including Koolboks (Nigeria, Kenya, Uganda and others), Aquarech (Kenya) and J-Palm (Liberia). Although this is encouraging, certain risks are emerging; a palm oil harvester seeking rewards for practices that have been recently defined as ‘sustainable’ highlights how poorly designed schemes could create perverse incentives. They may encourage communities to expect payment for natural resource management activities that are part of their everyday practice.

4. There is strong evidence that GSMA’s support for SMART technologies has improved access to utilities or services, reduced emissions, and improved household finances.

However, the specific impacts on climate vulnerabilities remain unclear. Businesses supported by GSMA have established use cases for smart mobile technology solutions that improve services and utilities while reducing carbon and methane emissions due to waste disposal (ReCircle's ClimaOne, in India, Freetown Waste Transformers, in Sierra Leone). Other such examples include clean cooking e-Cook stoves (ATEC, in Bangladesh) and cooling devices (Koolboks, in Nigeria]. These solutions reduce emissions and improve women's lives (time saving) and livelihoods (increased income or reduced costs). However, their impact on long-term climate vulnerability – such as resilience to extreme weather or sustained NRM – is less evident. For example, women using ATEC's e-Cook stoves save time and money in doing so, which would increase their resilience to shocks in a general sense. Yet the solution does not purposefully address risks associated with climate change that may be greater for populations living in areas threatened by specific climate-related hazards.

5. There is promising evidence that GSMA's support for climate tech enhances the

Box 6: Lersha (Ethiopia): an agritech start-up offering bundled support for smallholder farmers

Lersha ('for agriculture' in Amharic) connects 270,000-plus smallholder farmers with 250-plus service providers. Through its mobile app, farmers receive advice and services from Lersha 'Agents'. Its bundled support includes advisory services, access to inputs and mechanisation, financial services and market linkages.

A grant from GSMA aimed to enhance and scale its platform to deliver more tailored services, increase involvement from service providers, and provide regular agri-climate advice. A key focus was developing technology and institutional relationships to expand access to agricultural finance and climate-risk insurance

Lersha thus leveraged a diverse range of partnerships within the broad ecosystem of actors, and uses online and offline solutions. Results reported by smallholders include improved production, incomes and some adaptive capacity. This suggests that outcomes are potentially meaningful in terms of strengthening farmers' resilience to climate change. Yet there are still examples where farmers do not have access to sufficient resources to act on advice and adapt their farming practices to mitigate detrimental effects of climate change.

Furthermore, farmers that accessed support had slightly larger farms and higher incomes than average for Ethiopia, raising questions about levels of vulnerability of service users, but also possible positive impacts on wider communities and consumers. This is important as Lersha does seem to have navigated a challenging political environment (including armed conflict and economic shocks such as a tripling of fertiliser prices) with potential impacts also on consumers as well as producers.

For more information on Lersha, see GSMA's case study, [Digitising Agriculture and Unlocking Finance in Ethiopia](#).

absorptive and anticipatory capacities of vulnerable households through climate information and agricultural advice. However, use cases relating to more significant adaptation benefiting vulnerable communities are not yet fully established. Initiatives across countries such as Ethiopia (Lersha) (see Box 6), Nepal (Geo Krishi) and Nigeria (CoAmana) are demonstrating how smart technologies can strengthen the capacity of some vulnerable farmers to anticipate and or absorb the effects of climate change impacts, increasingly with a focus on reaching women. Yet despite innovation in pricing, financial services and 'phygital'⁶⁵ extension models, many start-ups still struggle to reach poor, disconnected farmers. Even when information is accessible, users (such as clients of Lersha's agricultural advice – see box 6) may lack the resources to act on it and make significant adaptations to their farming practices.

Evidence of impact often relies on short-term, self-reported data by the farmers themselves, and broader benefits to climate-vulnerable consumers of agricultural projects are rarely assessed.

⁶⁵ A combination of digital and offline mechanisms for engagement.

Nonetheless, the potential for community-wide impact and impact on vulnerable populations is evident in humanitarian initiatives. In Pakistan and Kenya, GSMA's partnerships under the Humanitarian Connectivity Charter (such as Early Warnings for All and AI-driven forest fire management) aim to reduce vulnerability at scale. In Kenya, GSMA's engagement with national cash transfer programmes and a World Vision (international NGO) project (described in Section 3.3.1) offered further opportunities to strengthen the absorptive capacity of larger at-risk populations.

6. There is strong evidence that GSMA has contributed to learning on potential opportunities and challenges relating to different uses of climate tech for NRM and environmental sustainability. In addition to sometimes controversial carbon credit and payment for ecosystem services mentioned earlier, we identified several other examples. One was from Kenya's Tana River Delta, where World Vision, Ushahidi and Safaricom used drones and mobile tools for participatory mapping to inform land regeneration and long-term development planning. In Indonesia, mobile-based community mapping in Sebatu supported local mangrove conservation and in another example BENAA's solar-powered wastewater treatment system, enabled by smart mobile tech, reduced agricultural water contamination – though most farmers were unaware of the improvement.

3.2.4 What are the enabling and disabling conditions for the achievement of outcomes and impacts in case study countries?

This subsection explores what our findings on activities and emerging outcomes reveal about the validity of the Climate Impact Narrative causal chain, and by association the Climate Tech theory of change (ToC). The discussion comprises two sections:

- **Implementation:** insights on causal mechanisms relating to activities and outputs described in the innovation model's Impact Narrative (EQ2.1).
- **Effectiveness:** factors that influence whether outputs are likely to contribute to reductions in emissions, or improvements in resilience, NRM or environmental sustainability (EQ2.3).

Consistent with the inception report, the evaluation team focused mostly on Kenya and Pakistan, but we also draw on insights from other locations. There is some discussion here of findings on relevance, and coherence with local priorities, consistent with the evaluation matrix (Table 1). However, it was not possible to assess these criteria robustly with a rubric. We also gave relatively light-touch consideration to the influence of mobile ecosystems and other economic, political, regulatory and social factors. Because primary and secondary data accessed through the evaluation is fragmented, and the formative evaluation design stressed comparison and analysis with evidence from EQ1 (the literature review), the implications of factors introduced in this subsection are considered under the third and final evaluation question, EQ3.

EQ2.4 headline finding: GSMA is effective in catalysing collaboration for climate action because it is skilled at leveraging the incentives of different actors. Whether these initiatives lead to climate and environmental outcomes at scale depends on complex, interrelated structural, political, economic, technological and social factors. Outcomes are also influenced by the coherence of GSMA's individual initiatives with other interventions supported by GSMA as well as those pursued by other actors in the climate ecosystem.

Implementation of the GSMA M4D Climate Action innovation model works because:

- Start-ups value the package of catalytic funding, technical and relational support:

- **GSMA's technical support** increases their capacity to develop solutions, professionalise operations and financial management,⁶⁶
- **GSMA's relational support** proffers legitimacy by creating opportunities for new or stronger⁶⁷ connections with MNOs. This can lead to integration of financial payment mechanisms, expansion of their customer base, and access to carbon credit markets.⁶⁸
- GSMA staff are skilled in leveraging various incentives that encourage multi stakeholder collaboration:
 - **Commercial:** MNOs are motivated to engage with other actors in the ecosystem by incentives such as CSR commitments, brand image, the use of core services, and opportunities to reach their wider customer base.⁶⁹
 - **Relational:** Partners in Pakistan and Kenya value multi-stakeholder approaches that foster innovation, collaboration and access to diverse perspectives.⁷⁰
 - **Policy related:** Government actors and donors in Pakistan see participation in GSMA-convened events as advancing their policy priorities.⁷¹
 - **De-risking:** Investors view GSMA alumni who have undergone rigorous due diligence as relatively lower risk, making their participation in boot camps worthwhile and their investment processes more efficient.⁷²
 - **Evidence and insights** produced by GSMA can support successful implementation. But this depends on the approach to generating and disseminating that evidence. Select and highly relevant insight reports may motivate some actors to attend meetings.⁷³ However, more engaged research – for example, involving stakeholders in the co creation of resources on the potential of AI for combatting Forest Fires in Pakistan and mapping land degradation in Kenya – may offer a promising alternative.⁷⁴

The effectiveness of GSMA's innovation model depends on four clusters of enabling/disabling conditions:

1. Relevance to various actors in the climate action ecosystem:

- **Government:** GSMA's Climate Action initiatives aligned closely with government climate and technology policies in both Pakistan and Kenya, providing incentives for government actors to collaborate with GSMA and/or its partners. This was particularly evident in Pakistan,⁷⁵ where GSMA has built strong relationships with successive administrations and engaged in government-led initiatives.⁷⁶ (In Sierra Leone and Nepal, partners similarly made progress because their solutions helped the local government to deliver on immediate policy

⁶⁶ KIIs 8 Grantees.

⁶⁷ KII 2 Grantees.

⁶⁸ A full list of advantages Startups experience from partnerships can be found in slide ten of the Private Sector Partnerships for Scale Learning Document; This triangulates with one KII with a partner.

⁶⁹ A full list of MNO incentives for partnerships can be found in slide 11 of the Private Sector Partnership for Scale Learning Document. This triangulates with KIIs with three MNOs, and casual conversations with 3 GSMA staff.

⁷⁰ Interviews with grantees and partners in Kenya and Pakistan.

⁷¹ KII Donor.

⁷² KII Global.

⁷³ KII with Partner

⁷⁴ Interviews with various Pakistan stakeholders and [Climate change adaptation and livelihood restoration in Tana River Delta | Mobile for Development](#)

⁷⁵ World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series;. © World Bank, Washington, DC. <http://hdl.handle.net/10986/38277> License: [CC BY-NC-ND.](#) [World Bank Document](#); [Revised Pakistan 2022 Floods Response Plan Final Report \(Issued 15 Dec 2023\) | OCHA](#), see more analysis in Pakistan case study (Annexe 3).

⁷⁶ KII GSMA Staff, Pakistan case study (Annexe 3).

commitments.⁷⁷ In India, ReCircle succeeded because its app helped other businesses comply with government EPR regulations.⁷⁸)

- **MNOs:** CSR policies aligned well in Indonesia and Pakistan.⁷⁹ Conversely, in Kenya, GSMA M4D's partner, Aquarech, found it more difficult to access MNO support as aquaculture was not yet seen as a CSR priority.⁸⁰
- **Donors and others:** GSMA's initiatives were relevant to donors, CSOs, and academics, adding value to existing climate action efforts. In Pakistan, the AI Forest Fires initiative built on FCDO-funded research by Lahore University of Management Sciences (LUMS) and the World Wildlife Fund for Nature (WWF).⁸¹ In Kenya, GSMA's engagement with Safaricom supported a community-led climate project implemented by World Vision.⁸²

2. Effectiveness in reaching and influencing intended audiences: Partners generally succeeded in making key technical features of their solutions function as intended. However, several factors affected the efficacy of information distribution channels:

- **Low mobile penetration rates, digital literacy and trust in technology:** These were the most common challenges reported.⁸³ Possible responses included interactive voice response (IVR) in Pakistan⁸⁴ and community trust-building and human-centred design in Kenya.⁸⁵
- **Power relations:** Prevailing discriminatory gender norms meant that women were rarely the main beneficiaries of partner solutions. Several partners in Kenya and Pakistan were experimenting with approaches to encourage women users.⁸⁶
- **Support from local communities or government actors:** Ujuzi Kilimo, one of GSMA's Kenyan grantees partnered with local agricultural extension services to gain community trust and reach users unable to access and or use mobile technology. CROP2X could not gain trust for its tech enabled agricultural advice in Pakistan without endorsement from local government.⁸⁷
- **Better alternatives:** Insights from Indonesia suggest that IoT solutions did not work to achieve shrimp farming outcomes, because there were cheaper ways to increase production. Furthermore, assumptions within the ToC that increased production would reduce mangrove destruction appear unfounded.⁸⁸
- **Political instability:** Climate related projects were disrupted by political instability in Pakistan, Ethiopia and Somaliland.⁸⁹
- **Surveillance and crackdowns:** Government surveillance and crackdowns on Geographic Information System (GIS) emerged as potential barriers to digital technology initiatives. In Kenya, allegations that Safaricom unlawfully shared customer location data with law enforcement raised concerns that could deter start-ups from entering partnerships for climate projects.⁹⁰

⁷⁷ GSMA case studies for each initiative:

⁷⁸ [Building a national circular supply chain platform – ReCircle's ClimaOne platform in India | Mobile for Development](#)

⁷⁹ KII GSMA staff, KII MNO

⁸⁰ KII with Grantee; KII with GSMA staff; GSMA Innovation Fund For Climate Resilience and Adaptation Final Reporting – AQUARECH LTD June – 2024.

⁸¹ KII Donor, GSMA staff

⁸² Climate change adaptation and livelihood restoration in Tana River Delta: Embracing innovative approaches and technology. May 2023.

⁸³ Examples mentioned in the previous section include Lersha, BKK, Freetown Waste Transformers and J-Palm.

⁸⁴ KII Partner

⁸⁵ Aquarech CRA Fund Final Reporting 2.0.pdf

⁸⁶ BKK and Aquarech made deliberate efforts to engage local communities, build credibility and enable women users. In Pakistan Buraq decided to include IVR functionality on the suggestion of GSMA; both BKK and CROP2X explored approaches to increasing women farmers' access.

⁸⁷ KII Ujuzi Kilimo, BKK.

⁸⁸ Interview GSMA Staff.

⁸⁹ [GSMA GSMA Digitising-Agriculture-and-Unlocking-Finance-in-Ethiopia_Lersha_2024.pdf](#)

Dayaxa Draft Case Study.

⁹⁰ Kenya case study (Annexe 6).

3. Financial viability of solutions and models. Even successful start-ups have struggled with pricing policies that fit their commercial and social objectives. Success is influenced by various factors:

- **MNO commercial priorities:** Market opportunities meant that in Kenya, Safaricom was incentivised to partner with 4R Digital on the Carbon Value Exchange (CaVEx) platform; however, it had little incentive to partner with Aquarech.⁹¹
- **The availability of the Universal Service Fund (USF):** GSMA Pakistan Mutual's strong relationship with the USF (which is financed by MNO tax revenue) incentivised MNOs to participate in initiatives with no commercial business case, such as the Smart Villages project and the AI Forest Fires initiative.⁹²
- **Opportunities to bundle financial services:** BKK, a grantee that already had a large customer base, struggled to make agricultural advisory services affordable to under-served groups. This is driving the integration of new services offering farmers loans or insurance.⁹³
- **Opportunities to leverage carbon credit markets/PES, etc.:** Partnerships with ATEC and 4R Digital and their work on mobile tech solutions for carbon credits, plus ongoing partner interest, suggest that GSMA is well positioned to leverage such opportunities for its partners and other stakeholders in Kenya, Pakistan and elsewhere.⁹⁴
- **Government policy on issues specific to carbon credits:** In Kenya, legislation means that government is likely to take a big share of carbon credit markets. This could have implications for other actors relying on credits as a revenue source.⁹⁵
- **Regulatory frameworks:** GSMA's analysis and advocacy in support of Pakistan's aspiration to become a digital nation indicates that government regulation makes MNO profitability challenging.⁹⁶

4. Internal and external coherence that enables GSMA initiatives to add up to more than the sum of their parts:

- **Within GSMA:** GSMA's organisational structure has made it challenging to adopt a coherent approach in both Pakistan and Kenya (for a more detailed discussion of this, see EQ2.5, below). Yet there are encouraging examples to build on. Its Climate Tech and Digital Utilities teams are collaborating on the circular economy and waste management in Kenya. In Pakistan, we found increasing coherence in programme work that brought together M4D grantees working on resilience in agriculture with stakeholders involved in early warning systems.⁹⁷
- **External to GSMA:** GSMA appears to be having greater impact on larger and more vulnerable populations through identifying and leveraging synergies with other actors in the climate action ecosystem. Examples include its support for World Vision's work to improve degraded land in Kenya, and WWF and LUMS participatory approaches to promoting the potential of AI in Pakistan.⁹⁸

⁹¹ KII with GSMA staff; GSMA Innovation Fund For Climate Resilience and Adaptation Final Reporting – AQUARECH LTD June – 2024.

⁹² KIIs 2 GSMA Staff.

⁹³ BKK Impact Case Study.

⁹⁴ KIIs 1 Partner, 1 Grantee.

⁹⁵ KII partner.

⁹⁶ GSMA (2024) [Realising Pakistan's Aspiration to become a Digital Nation](#)

⁹⁷ See Kenya and Pakistan case studies (annexes 6 and 7).

⁹⁸ See Annexe 6 (Kenya case study) and Annexe 7 (Pakistan case study) and Annexe 9 (Outcome analysis)

3.2.5 How does the GSMA programme context influence the efficiency and effectiveness of Climate Action outputs and outcomes?

EQ2.5 headline finding: GSMA M4D's small, competent and committed teams have developed robust climate action frameworks and monitoring approaches that strengthen programming and learning on factors that help and hinder its climate ambitions. However, certain elements – the design of the Innovation Fund, organisational structures and approaches to strategy as well as donor incentives – make it challenging to implement collaborative and contextually informed climate actions.

GSMA's Climate Tech team has made progress developing systems to support effective climate action. This is evidenced in theories of change,⁹⁹ impact narratives¹⁰⁰ and ongoing efforts to enhance monitoring and learning systems.¹⁰¹ GSMA is continuing to strengthen its MEL capacity for understanding what, how and why technology is contributing to absorptive, anticipatory and adaptive capacities and improved NRM and environmental sustainability, as can be seen in case studies for Round 4 grantees.¹⁰² Furthermore, the M4H learning plan for Round 5 of the Innovation Fund explores important questions relating to anticipatory capacities and the financial sustainability of GSMA-supported technological solutions.¹⁰³ These systems are still evolving, however, and endline climate outcome data from Innovation Fund grantees has only emerged recently. The evaluation team found little evidence that many interventions were informed by detailed analysis of the factors that influence climate vulnerability in a given context.¹⁰⁴ Moreover, much of the climate focus was applied retrospectively, with pre-2022 grants and non-grant initiatives (now considered part of the climate portfolio) missing climate outcome data.¹⁰⁵ Additionally, GSMA lacks a centralised information system that can provide clear visibility of cross-team Climate Action initiatives and strategies for supporting climate work beyond the insight reports and Innovation Fund rounds.

The Innovation Fund design does not encourage an adaptive approach. This makes the innovation model and GSMA M4D's climate ambitions less efficient and less effective. Key weaknesses include the following:

- **Its centralised nature and dominance in the Climate Action innovation model.** The globally managed Innovation Fund is considered by many respondents to be the most important component of the Climate Action innovation model.¹⁰⁶ Its open-call approach, spanning geographies and themes, presents challenges for contextually embedded programming and learning. The open-call process (for example, the Climate Adaptation and Resilience Round)¹⁰⁷ has led to a wide range of grants focused on different themes, testing technologies in 10 countries, few of which have a GSMA presence. This makes it difficult to provide meaningful support or opportunities for shared learning and insights.¹⁰⁸
- **Periodic open calls are the sole approach to grant-making.** Current policy restricts the Innovation Fund to open calls, essentially disconnecting it from more strategic, country-level

⁹⁹ The Climate Tech team has its own theory of change.

¹⁰⁰ See the Climate Impact Narrative being used as the conceptual framework for the evaluation.

¹⁰¹ Recent case studies for Round 4 grantees (for example, Lersha, BKK and Dayaxa) all describe project aims and intended outcomes using concepts relating to mitigation, resilience, NRM or environmental sustainability.

¹⁰² For example, case studies for [Lersha](#), [BKK](#), [Geo Krishi](#), [CoAmana](#) and [Dayaxa](#).

¹⁰³ M4H Learning plan for the anticipatory resilience Innovation Fund round.

¹⁰⁴ The Evaluation case studies for Kenya and Pakistan look somewhat superficially and retrospectively at how various interventions align with policy and contextual factors influence the enabling environment, but we were not shown evidence of in-depth context analysis at the level of interventions.

¹⁰⁵ For example, Wonderkid.

¹⁰⁶ This was surfaced in many interviews with GSMA staff.

¹⁰⁷ Innovation Fund Round 4.

¹⁰⁸ A couple of grantees commented that they would have liked more opportunities to learn with in-country peers.

work. GSMA teams cannot target specific grants to organisations within a given ecosystem.¹⁰⁹ For instance, if Digital Utilities/Climate Tech teams identify opportunities through their country work, they have to leverage funds locally from other actors to support them (as was the case for work on Smart Villages and Waste Management in Pakistan).¹¹⁰ Though this is commendable, it makes opportunist and adaptive working very difficult.

- **Inefficient and sometime ineffective grant selection process.** Open calls (for climate and other rounds) require significant effort from applicants and grant managers alike at the initial application and shortlisting stage, and subsequently, when shortlisted applications are pitched to the Fund's selection panel. With 6.4% of the 2,900+ applications shortlisted and only 2.5% of applications being successful,¹¹¹ the grant selection process is time-intensive and costly, for unsuccessful grantees and GSMA staff alike.¹¹² Despite these efforts, some funded projects include assumptions that underestimate the need for offline support in sharing and explaining climate information (see EQ3).¹¹³
- **Restrictive budgets make adaptation challenging.** Several grantees remarked that it is difficult to address unanticipated issues. These include unexpected currency fluctuations, projects that evolve with timelines that differ from budget phasing, and budget structures that initially underestimated the funding required for technology solutions.¹¹⁴

GSMA's organisational structure and ways of working affect the efficiency, effectiveness and value-for-money of the innovation model and its Climate Action initiatives. GSMA M4D often lacks staff or country-level strategies in places where it funds projects. Most Innovation Fund grants are managed from London or countries other than those where the grantees are working.¹¹⁵ This can result in siloed implementation, even in countries such as Kenya, where M4D does have a presence. Without coordinated country strategies, opportunities for collaboration between initiatives (whether receiving grants from the Fund or not) may be missed.¹¹⁶ Similar grants under different themes (e.g. M4D and M4H) are not always well connected to each other locally, particularly if they are managed by different GSMA teams.¹¹⁷ In countries such as Kenya and Pakistan, the success of GSMA-supported climate initiatives often depends on individual staff members' relationships and their ability to engage politically with governments, MNOs, civil society, and private sector actors.¹¹⁸ In Pakistan, for example, political transitions exposed a lack of sustained M4D follow-up due to limited staffing.¹¹⁹ Additionally, the strategic influence of a GSMA Mutual Policy Officer on national climate policy was not fully recognised by M4D, potentially reducing opportunities for internal collaboration.¹²⁰

Supportive donor relationships have enabled GSMA to progress work within its Climate Action innovation model. Adaptations to current key performance indicators (KPIs) could advance this further. Supportive donors such as FCDO and Sida value GSMA M4D's climate-related outputs.¹²¹ Yet the quantitative metrics chosen for KPIs on insight products and grantee

¹⁰⁹ KII with 5 GSMA Staff.

¹¹⁰ KII GSMA Staff and Smart Villages and LWMC documentation.

¹¹¹ Presentation at the GSMA boot camp in Nairobi in February 2025 stated that of more than 2,900 applications to Innovation Fund calls, over 180 applications were shortlisted, and 71 grants funded. These summary figures relate to all Innovation Fund calls, not just the climate-related ones.

¹¹² GSMA Innovation Fund Process Evaluation report, May 2023.

¹¹³ Several grantees have underestimated the amount of offline support required for vulnerable users to be able to understand information and consider using it.

¹¹⁴ Several grantees commented on how difficult it was to cope with higher-than-expected costs during initial stages of solution implementation and/or exchange rate fluctuations that increased costs.

¹¹⁵ See earlier discussion of staff locations.

¹¹⁶ The GSMA Innovation Fund process evaluation.

¹¹⁷ Synnefa, a partner supported by M4H and Ujuzi Kilimo by M4D, are two such examples in Kenya.

¹¹⁸ KII GSMA Staff in Pakistan and Kenya.

¹¹⁹ See Pakistan case study (Annexe 7).

¹²⁰ See Pakistan case study (Annexe 7).

¹²¹ See, for example, FCDO comments on the quality of climate-related insight reports.

applications tend to incentivise siloed thinking.¹²² These metrics do not (for example) create incentives for critical and reflexive learning on how interconnected activities and themes (within the innovation model) could be made more effective – something that should be central to an innovation model.

¹²² Several GSMA staff remarked on this – that the nature of KPIs did not encourage monitoring of insights or forging partnerships on advocacy and related outcomes.

3.3 EQ3: Drawing conclusions and making recommendations

This subsection draws conclusions on the final evaluation question, EQ3: *What are the opportunities for M4D's approach to digital tech innovation and collaboration to have a strategic impact on climate action to address climate vulnerability?*

The discussion brings together insights from the broader evidence base (EQ1), the evaluation of GSMA's climate portfolio (EQ2), and further analysis and insights into effective climate actions. We make recommendations on opportunities for GSMA to strengthen its strategic position and approach, so that it succeeds in deepening its contribution to inclusive, meaningful and sustainable climate change impacts.

EQ3 headline conclusion: GSMA's strategic niche in the climate action ecosystem is to leverage its connections to MNOs and mobile digital innovation to further technologies and partnerships that advance climate change impacts across commercial, non-commercial and combined models. The opportunities for GSMA M4D's approach to have strategic impact involve more intentional and robust understanding of the climate ecosystems it engages with, and working more effectively with local and other actors. This would entail updating its Climate Action theory of change to be more consistent with the broader evidence on climate action. GSMA should make adjustments to its strategic planning and implementation to build on and deepen its organisational niche, role, practices and strengths for understanding, connecting, supporting and strengthening climate tech businesses, MNOs and other climate actors and approaches. Developing its niche in this way would enable it to more effectively leverage mobile digital technologies for meaningful, inclusive and sustainable climate impacts.

3.3.1 The appropriateness of GSMA M4D's theory of change

EQ3.1. What does evidence from inquiries into EQ1 and EQ2 suggest about the appropriateness of M4D's current use case regarding digital tech innovation for climate action and mitigation, adaptation, resilience, NRM and environmental sustainability?

EQ3.1 headline finding: GSMA's use case for strengthening the role of mobile digital actors and technologies to achieve climate change outcomes – particularly the ToC, problem analysis and assumptions – does not fully reflect emerging insights from the broader evidence on digital technology for climate action (EQ1); nor does it align with the organisation's own diverse experiences across issues, contexts and partners (EQ2). In general, the ToC and most of GSMA M4D's Climate Action initiatives do not reflect a full understanding of the complexities of the systems involved in advancing equitable, effective and sustainable climate impacts. However, some GSMA partners have adopted a more systemic approach, in terms of engaging broader actors and contributing to more holistic climate actions. This has contributed to more promising climate change outcomes.

This subsection examines the appropriateness of the 'use case' – the theory of change underpinning GSMA's climate portfolio. We begin by reviewing elements of the ToC within the M4D climate portfolio. The portfolio itself does not have an explicit or unified ToC, so we drew principally on the Climate Impact Narrative, as well as the ToC of the Climate Tech programme. We acknowledge that the Climate Impact Narrative was not developed to be a ToC, but as it contains many relevant elements, it was a useful lens for understanding GSMA's thinking.

Within the climate portfolio ToC, we focus on the problem analysis and implicit causal assumptions, vis-à-vis the evidence presented in EQ1. This is followed by a short discussion of three illustrative partnerships (Wonderkid and World Vision in Kenya, and BKK in Pakistan) that demonstrate evidence on how these assumptions may influence the extent to which the initiatives supported by GSMA M4D achieved its climate outcomes.

Problem analysis and related evidence

The M4D problem analysis at portfolio, programme and country levels lacks a comprehensive and systematic assessment of the core climate change problems GSMA is working to address in a way that informs its approaches, strategies and actions with target populations. In practice, the problem analysis underpinning the climate portfolio (reflected in the Impact Narrative and Climate Tech ToC) aligns with the programmatic approaches and technological solutions that GSMA is most focused on, rather than the climate change impacts it seeks to achieve.¹²³ The assessment of the problem analysis presented in Annexe 12 points to significant gaps in key areas: articulation and analysis of the main drivers that make target populations more vulnerable to climate change; and the broader systems, governance and political economy factors that affect the climate change outcomes GSMA is working towards.

Critically, there is considerable evidence (EQ1) that a weak problem analysis often leads to narrow, isolated and technical approaches that do not strengthen climate resilience in meaningful or sustainable ways. This then often leads to shorter-term ‘coping’ adaptations or unconnected incremental improvements, presenting further barriers to more coherent and holistic capacities and strategies for resilience.

For example, there is little evidence that in Kenya or Pakistan, GSMA undertook a contextualised analysis of the climate challenges affecting target populations that could have informed its programming priorities. One notable omission stands out: the lack of an explicit assessment of the implications of political economy, governance and institutional factors that shape mobile digital technologies and services (see Section 3.1.1).

The broader evidence presented in EQ1 (Section 3.1) suggests that a wider set of actors and actions either help or hinder climate actions and outcomes. This in turn suggests the need for a more robust understanding of the climate action ecosystem in each context, which goes beyond those actors and efforts that GSMA has generally engaged with when leveraging digital mobile tech for climate action. There should be a broader stakeholder mapping of the climate action ecosystem, to include other actors and initiatives working towards shared objectives, identifying potential opportunities to complement and/or integrate mobile digital technologies with these efforts in order to maximise impact.

Key assumptions underlying the GSMA Climate Tech theory of change

The M4D Climate Tech portfolio is underpinned by assumptions that are generally not well supported by the broader evidence. GSMA M4D’s Climate Impact Narrative, ToC and other strategy documents do not clearly set out the assumptions underpinning the strategic logic of the Climate Tech portfolio. The evaluation team assessed these documents, articulated the implicit assumptions, and discussed these with GSMA staff during the evaluation process. We list these six assumptions in Box 7. For a complete articulation and analysis, including examples in practice, see Annexe 12.

Box 7: Assumptions underlying GSMA’s use case and theory of change

¹²³ GSMA Mobile for Development Climate Impact Narrative, GSMA 2023.

1. *The uses of mobile digital technology by and for vulnerable groups to achieve inclusive, meaningful and sustainable climate change outcomes are those that are also commercially viable and scalable by MNOs and other businesses.*
2. *Improving the efficiency of public utilities and agricultural production contributes to broader climate change resilience.*
3. *The most relevant and impactful uses of mobile digital technology for meaningful climate action and outcomes for vulnerable groups are those that are also economically viable and scalable.*
4. *Relatively light-touch, relatively isolated technology-based solutions – particularly those that increase information and awareness of individuals and groups – contribute to meaningful mitigation, adaptation, resilience, NRM and environmental sustainability for vulnerable groups.*
5. *There will be no unforeseen negative consequences of relatively light-touch, relatively isolated technology solutions (that are economically viable and scalable) seeking to contribute to meaningful resilience, adaptation and environmental management, particularly for vulnerable groups.*
6. *It is not necessary to engage more intentionally with and co-create mobile-based climate actions with vulnerable populations, including civic actors that represent and/or are embedded with these populations.*

For example, with respect to assumption 4, there is a strong emphasis in the Climate Tech Impact Narrative on mobile digital technology solutions that provide information to a range of actors including vulnerable individuals, households and communities. The assumption is that these actors and groups can then take meaningful actions to reduce their vulnerabilities, sustainably manage their natural resources, etc. However, there is significant evidence (summarised in EQ1) that providing information, on its own, is insufficient, because of the wide range of factors that shape the capacities of vulnerable groups and constrain their ability to take action that would make them less vulnerable. Even when people do act on the information they receive, this generally only leads to modest positive climate outcomes, again due to the broader constraints and causal factors that underpin people’s vulnerability. This assumption does not always apply in practice, as GSMA staff and partners often seek to go beyond information provision and enable access to resources – for example, through the provision of financial services needed for action.¹²⁴

Partnerships and initiatives across GSMA M4D’s climate portfolio reflect some or all of these assumptions (see examples from Kenya and Pakistan below), and in some cases they may actually hold true. However, where programmes, partnerships or grants are based on several or all of these assumptions, there are significant questions about whether they can help GSMA achieve its climate impact objectives, particularly around impacts for vulnerable groups. (See examples below).

Climate change outcomes and related evidence

The extent to which GSMA’s support for partners and projects contributes to inclusive, meaningful and sustainable climate change outcomes is generally uneven (see EQ2, and the Kenya and Pakistan case studies, annexes 6 and 7). This is partly due to the quality of its underlying analysis and the assumptions outlined above, as well as other strategic and implementation factors, including gaps in MEL. Limited outcomes partly reflect the lack of a comprehensive and systematic analysis and approach to leveraging mobile digital technologies for climate change impact. Our exploration of EQ2 establishes that GSMA-supported partners and projects have contributed to climate change outcomes related to mitigation, adaptation and NRM. However, the extent and nature of these outcomes vary considerably. For example, despite significant efforts, there are questions about the extent to which outcomes benefit more vulnerable groups and significantly reduce their vulnerabilities. Although GSMA’s contribution to humanitarian efforts such as supporting the use of technology in national cash transfer

¹²⁴ This is reported in [GSMA’s Lersha impact case study](#). BKK is seeking to increase user access to financial services.

programmes in Kenya¹²⁵ may support vulnerable people's absorptive capacity, there are few examples of GSMA initiatives meeting longer-term adaptive needs. Furthermore, there are other questions about the extent to which the outcomes make a meaningful difference relative to the climate challenge being addressed. Finally, it is often unclear whether any positive outcomes will be sustained over time, particularly given the short-term involvement of GSMA in many cases. For these reasons, it is important to further explore the outcomes achieved and what insights this generates about GSMA's climate portfolio ToC.

Below, we use two case studies (see Box 10 and 11) to explore how some GSMA partners and projects are contributing to climate outcomes that are inclusive (reaching more vulnerable groups), meaningful (relative to the problem they seek to address) and sustainable over time.

Generally, the evidence of climate outcomes is limited and uneven. Often, this reflects gaps in the problem analysis and assumptions (which we have already discussed) but other factors may also play a role:

- Projects and partnerships that are nascent and so have not yet contributed to climate change outcomes.
- GSMA and partners' MEL systems, including indicators and data collection tools, do not always identify, collect and/or document evidence of climate change outcomes.
- Some interventions (undertaken by GSMA projects and partners) may have contributed to positive outcomes in other respects but not to climate outcomes.

Overall, this suggests that GSMA's ToC and subsequent partnerships and implementation are generally not sufficiently informed by a robust understanding of the relevant climate change systems, with some notable exceptions. This is demonstrated in two examples that have generated little evidence of climate change outcomes: Wonderkid, a mature, scaled-up model supported by the Digital Utilities programme (see Box 8); and a more nascent initiative, the Indonesia Mobile Innovation Hub (see Box 9). Both examples demonstrate key weaknesses of GSMA M4D in terms of its Climate Tech portfolio problem analysis and assumptions – weaknesses that have undermined progress towards inclusive, meaningful and sustainable climate outcomes.

Box 8: Wonderkid, Kenya: successful scale-up of customer feedback system, but does it impact the urban residents most vulnerable to climate change?

Ensuring efficiency of water utilities is seen by GSMA as key to addressing challenges relating to climate induced water shortages. Wonderkid a Kenyan start-up founded in 2012 that provides a customer feedback system dubbed "Maji Voice" is viewed as a tech supported approach to enable this.¹²⁶ The system was rolled out in 2013 with Nairobi Water company and customers could report complaints via SMS, USSD, a mobile app or a web platform. By 2014, it was processing 6,000 complaints per month with most of the complaints being around water billing Wonderkid saw the opportunity to address this by developing a mobile app to digitize the process of capturing water meter readings and customer billing by the utility firm. Improved efficiency in billing would arguably contribute to a companies ability to provide efficient water utility services to customers.

The Digital Utilities programme first engaged with Wonderkid to further develop their platform and expand to other utility companies. At the conclusion of the grant in 2017, the project had supported improvement in quality of service to over 500,000 users and led to a 28% increase in revenue to the partner water companies. The platform has evolved to a commercially successful enterprise management system that is currently in use in Kenya and 8 other countries by over 80 clients. Since the end of the grant in 2018 GSMA

¹²⁵ [Partnering with CARE Kenya on digitising emergency response to drought and food insecurity – GSMA](#) (2025); M4H 2024 Annual Report.

¹²⁶ [Scaling Digital Solutions in the Water Sector – Lessons from CityTaps and Wonderkid](#). GSMA 2020

have continued to provide Wonderkid access and visibility in fora as well as links to MNOs.¹²⁷ As a result of this visibility and the new partnerships, Wonderkid are now working in Kenya, Malawi, Tanzania, Zanzibar, Nigeria and Liberia.¹²⁸ However, assumptions that this improved billing and feedback system will automatically result in better water services is not supported by the broader evidence base.¹²⁹

A 2016 meta-analysis of digital tools and platforms for citizens to inform government about service delivery issues (often through complaints mechanisms) raised questions about their efficacy.¹³⁰ The authors found that digital platforms that collected information from citizens about service provision and presented it to decision-makers rarely resulted in improved services. Wherever government actors were not willing (or lacked capacity) to improve services, the availability of citizen-generated information about service needs or deficits did not lead them to make such changes, even when their inaction was publicised on a website showing reported service needs that had gone unattended. Conversely, where government actors were interested in improving services, digital platforms could provide them with relevant information to act on. In other words, digital platforms cannot influence political will, but where such political will exists, they can help decision-makers take more informed decisions. This applies more generally, in that some inefficiencies in payments systems (for example) may actually reflect the incentives of service providers, who may seek to collect informal payments from users. It is therefore important to analyse and understand the political economy and governance factors around urban service provision to inform efforts to improve services for customers.

More broadly, there appears to be little evidence of the extent to which the efficiency improvements generated by the Wonderkid platform translate into improved access, quality and resilience of services – particularly for the urban residents most vulnerable to the effects of climate change. Wonderkid argues that these efficiencies help the water companies to be more climate resilient and provide greater service coverage.¹³¹ However, the evidence to justify this assumption is lacking, as it does not seem to have tracked or assessed these outcomes.

Overall, Wonderkid’s problem analysis, assumptions, indicators and business model do not clearly align with GSMA M4D’s inclusive and meaningful climate change outcomes, despite the successful scaling up of its service and the benefits it provides to water utilities.

Examples from Indonesia show more understanding of the need to consider strategic contextual factors in assumptions underpinning the design of climate change initiatives. However, again these were not comprehensive and like the Wonderkid examples, MIH also reflected inadequate indicators or MEL tools through which to make links with or track its climate change outcomes.

Box 9: Mobile Innovation Hub (Indonesia): isolated, commercially focused, information-heavy intervention

GSMA’s Mobile Innovation Hub (MIH) ‘works across multiple focus areas that sit at the intersection of mobile, digital innovation, sustainable development, and climate action’.

A 2022 study by GSMA identified three main barriers to adoption of digital tech solutions in Indonesia: (1) limited digital infrastructure (particularly in rural areas) and access to affordable, connected devices; (2) low digital literacy; and (3) lack of policy incentives, weak regulations, and limited collaboration between government and other actors.

¹²⁷ KII with Wonderkid

¹²⁸ KII with Wonderkid

¹²⁹ Peixoto, Tiago; Fox, Jonathan. 2016. When Does ICT-Enabled Citizen Voice Lead to Government Responsiveness?. WDR 2016 Background Paper;. © World Bank. <http://hdl.handle.net/10986/23650> License: CC BY 3.0 IGO.

¹³⁰ Peixoto, Tiago; Fox, Jonathan. 2016. When Does ICT-Enabled Citizen Voice Lead to Government Responsiveness?. WDR 2016 Background Paper;. © World Bank. <http://hdl.handle.net/10986/23650> License: CC BY 3.0 IGO.

¹³¹ KII with Wonderkid

In efforts to address this both in terms of macro level collaboration and more specific projects, GSMA convened different government actors to discuss possible areas for projects and they chose three focus areas for climate action: energy, waste, and natural resource management.¹³²

While this process intentionally and usefully engaged important government actors on the potential of climate tech, the MIH approach reflects most of the underlying assumptions in the GSMA theory of change (see Box x, Section 3.3.1). The theory of change for MIH says that partnership and technical assistance activities will increase knowledge and commitment among actors, leading to scalable pilots designed to achieve climate impacts. Yet project outcomes generally focus on uptake of the tech solution without emphasising climate related aspects. Furthermore, there seems little consideration of the vulnerabilities of target populations.

Projects tended to be short-term and light-touch (partly due to the nature of GIZ funding). Though an independent evaluation found that several achieved positive incremental progress in raising awareness on climate change and action,¹³³ several did not. Therefore there are questions as to whether that progress can be sustained and lead to meaningful climate change outcomes.

For more information on MIH, see GSMA (2022) [The state of mobile-enabled climate technology in Indonesia](#) and [Mobile technology-powered projects make significant strides in raising awareness on climate change among Indonesian communities](#)

Other GSMA-supported partnerships and programmes appear (for example the Lersha example above Box X) less reliant on unrealistic assumptions outlined earlier. Indeed, several demonstrate a stronger implicit analysis of the climate problems they set out to address.

However, they still face challenges in ensuring that these outcomes are meaningful, inclusive and sustainable for the vulnerable target populations. We present two more examples briefly mentioned in EQ2 here: BKK in Pakistan (see Box 10) and World Vision Kenya (see Box 11).

Box 10: BKK (BaKhabar Kissan), Pakistan: conducted problem analysis of challenges facing target groups, but still trying to reach the poorest farmers

8.2 million smallholder farmers in Pakistan work to meet the basic food and nutrition requirements of the country's population. However, a lack of weather data stations and high-quality weather data reduces their anticipatory and adaptive capacities. This hinders food security and has left poor communities, particularly farmers, even more vulnerable to the effects of climate change. [BaKhabar Kissan](#) (BKK) aim to address this problem through a network of weather stations providing hyperlocal weather information as well as enabling access to agricultural expertise through digital platforms.

With support from GSMA, BKK improved its local forecasting capabilities and enhanced mobile-based climate advisory services providing farmers with guidance on sustainable farming practices tailored to local climate conditions and challenges. Because it is locally embedded BKK has been able to engage communities effectively in efforts to disseminate weather forecasts and information on climate smart agriculture. BKK has tested IVR in some areas and is learning and adapting to reach more users in more local languages. This is just one example that indicates BKK has done some analysis of causes of climate vulnerabilities and takes these into consideration in its efforts to make the information it provides accessible and useful to illiterate farmers.

BKK is also testing pricing models that entail free services (the 'freemium' model) to some users and paid services to others, while trying to increase its revenue streams in other ways (e.g. offering financial services that involve selling client data and tapping into carbon markets).

Evidence collected by GSMA convincingly demonstrates that because of strategic relationships with MNOs, BKK's free and paid weather information service grew significantly over the period of the grant. Despite

¹³² KII GSMA staff; GSMA (2022). The state of mobile-enabled climate technology in Indonesia.

¹³³ [Mobile technology-powered projects make significant strides in raising awareness on climate change among Indonesian communities](#)

some regional variation, the vast majority of farmers using BKK's services (over 80%) claim to be using them to adapt and change. However, it is difficult to assess how many of the 40,000 or more farmers cited as using its advice are very poor. It is also hard to know whether those who had accessed the information had been able to apply new guidance on rotation and sustainable management. Although free information is appreciated by farmers, our literature review (EQ1) suggests that information alone is unlikely to improve the adaptive capacities of poor farmers or address their vulnerabilities. Financial services may help to some degree. However, to make significant adaptations, poor farmers will also need support from other actors in the climate action ecosystem.

To sum up, BKK has achieved significant scale in reaching farmers with climate information and services to help them adapt including very poor and vulnerable groups. However, there still are challenges to ensuring these important efforts result in inclusive and meaningful adaptive capacity.

More information on BKK can be found here: [Leveraging Digital Technology for Climate-Smart Farming in Pakistan: BKK | Mobile for Development](#)

An example from Kenya (see Box 11) goes further in illustrating how information generated by technology interventions can be leveraged and made more useful within the context of long term holistic and participatory approaches to building resilience and NRM with communities.

Box 11: World Vision Kenya: a holistic approach that engages diverse stakeholders and reaches vulnerable groups

World Vision Kenya is working to address ecosystem degradation due to unsustainable rural livelihood practices through a holistic, participatory and community-led resilience and NRM strategy. The Tana River Climate Change and Livelihoods Restoration Project (**T-CLIRP**) was part of WVK's broader emergency response program that offers vital services like water, sanitation, nutrition, and economic recovery to drought-affected communities across Kenya. T-CLIRP aims to improve long-term resilience by focusing on sustainable natural resource management, farmland restoration, and ecosystem strengthening for nine communities in the Delta.

The project, which ran from October 2021 to September 2022 integrated mobile technology, from lower tech SMS/USDD communication to mobile money to mapping and geo-tagging into their approach to building resilience and NRM. World Vision partnered with Safaricom, Ushahidi, Flying Labs and Seedballs Kenya, GSMA and communities in the Tana River Delta to use drone and mobile phone technology to support engaged research and mapping for clearing and regenerating degraded land. The platform allows communities to voice concerns on natural resource management and document their experiences with climate change - the intention is to empower these communities to take action.

The intermediate outcomes of the partnership were a map of 2,250 acres of land, identifying 250 acres for restoration. The findings were shared with communities, county government and Kenya Forest Services to create site maps action plans for clearing and reseeding degraded areas. To encourage further action these were then included into the government's five-year official Tana River County Integrated Development Plan. While final results will have depended on government resources, continued incentives and relationships for ongoing collaboration, evidence from EQ1 suggests that the participatory process and co construction of the solution made further action more likely than would likely be possible through an approach driven purely by technology and business interests.

The World Vision Tana River project is possibly the best example of a GSMA-supported project whose approach is aligned with the evidence in EQ1. It reflects efforts to understand the local climate ecosystem, use a holistic approach, engage with diverse stakeholders (particularly reaching out to vulnerable people and communities), and working in tandem with relevant institutions and governance structures.

For more information: [Climate change adaptation and livelihood restoration in Tana River Delta | Mobile for Development](#)

In the next subsection, we extend this analysis further. We explore how understanding and leveraging GSMA M4D's niche, role and opportunities can maximise its contributions to inclusive, meaningful and sustainable climate change impacts for vulnerable target groups.

3.3.2 GSMA's niche in the climate action space

EQ3.2. What is M4D's potential niche and where are the opportunities for M4D's approach to digital tech to have a strategic impact on climate action to address climate vulnerability?

EQ3.2 headline conclusion: GSMA's strategic niche in the climate action ecosystem is to leverage its connections to MNOs and mobile digital innovation to explore, test and scale technologies and partnerships that advance climate change impacts across commercial, non-commercial and combined models. GSMA could strengthen its contribution to this strategic impact by adopting a more consistent ecosystems approach. This requires GSMA and its partners to: (1) deepen their understanding of the relevant climate change actors and factors in a particular context; (2) engage with a broader set of climate organisations and initiatives; and (3) develop a more explicit and coherent strategic approach to achieving equitable, meaningful and sustainable climate change outcomes.

Here, we discuss GSMA's strategic niche, role and positioning, and the opportunities for its climate change approach to have more meaningful, inclusive and sustainable impacts. First, we present three impact pathways (or models) for leveraging digital technologies, detailing GSMA's current and potential role and contribution. Second, we articulate an overall ecosystems approach that could maximise GSMA's strategic impact. Finally, we illustrate this approach with a specific example (see Box 13). Further examples can be found in Annexe 10.

Three models for leveraging mobile digital technology for climate impact

Given GSMA's connections to MNOs, it has largely sought to leverage these relationships to develop and scale commercially viable mobile digital technologies and approaches. This approach has significant advantages, but the discussion of the ToC and examples set out in EQ3.3.1 also suggest some limitations. GSMA should consider how to leverage its potential role and contribution to three models – commercial, non-commercial and combined (see Box 12) – to support the use of mobile digital technologies for climate impact.

Box 12: Three models of how to leverage digital technologies for greater climate impact

1. **Commercially viable uses of mobile digital technologies that meet a clear need and reach significant scale**

Overall potential feasibility and impact:

- Generally strong feasibility (some failures could be avoided with more assessment and integration of actors, challenges and constraints, and policy-enabling environment).
- Variable climate impact (generally low to moderate).

2. **Non-commercially viable uses of mobile digital technologies as part of more holistic approaches to addressing significant climate challenges**

Overall potential feasibility and impact:

- Variable potential feasibility (depends on source of climate financing and leadership that shapes a conducive enabling environment and anchors collective progress).
- Variable climate impact (generally moderate, but potentially greater where holistic and systemic approaches can be put in place).

3. **Combining commercial and non-commercial uses of mobile digital technologies as part of more holistic approaches to addressing significant climate challenges**

Overall potential feasibility and impact:

- Variable potential feasibility (depends on source of non-commercial climate financing and leadership that shapes a conducive enabling environment and anchors collective progress).
- Strong climate impact (potential for high impact where holistic and systemic approaches can be complemented at scale through commercially viable services or

The three models mainly vary in their financial basis: commercial, non-commercial, and combined approaches. As already noted, much of GSMA’s work has focused on the first of these, but there are some examples of projects that have followed other models. These include GSMA’s efforts to leverage MNOs’ CSR agenda and take advantage of the USF fund in Pakistan, to name just one (see EQ2.3 and EQ2.4). Assessing these models will provide further insights into how GSMA can further strengthen its niche, role and contribution to inclusive, meaningful and sustainable climate impacts. A full articulation of the models can be found in Annexe 13, but a brief summary of the feasibility and impact of each is presented below.

The analysis of models in Annexe 13 suggests that GSMA’s dominant focus on the commercially viable model to date does correlate with the limited evidence of equitable, meaningful and sustainable climate change impacts demonstrated across the M4D climate portfolio. The analysis highlights important trade-offs between the feasibility of commercially viable technologies and business models, and the potential for achieving more inclusive, meaningful and sustainable impacts through non-commercial or combined models. However, the models do suggest that there are possibilities for GSMA to leverage its role and contribution to mobile digital technologies for greater climate impact through each model.

GSMA’s current approach generally starts from MNOs, mobile digital start-ups and technologies, and seeks to leverage these for climate outcomes. This is particularly notable for initiatives supported under the Innovation Fund. However, as the discussion on outcomes (Section 3.3.1)

highlights, many grantees have struggled to navigate tensions and trade-offs between scale, inclusion and impact.

A complementary approach would be to bring in considerations of scale, inclusion and impact from the start. In other words, begin by defining what inclusive, meaningful and sustainable impact would look like for a particular climate issue and for vulnerable population groups. Then undertake problem analysis and system mapping around this. Then explore how MNOs and mobile digital technologies could be best leveraged to contribute to these impacts, alongside a broader ecosystem of climate actors and efforts. This would entail looking both from the perspective of GSMA's niche vis-à-vis MNOs and mobile digital tech and that of climate impacts and systems. This could include exploring possibilities to combine commercial and non-commercial uses of mobile digital technologies (the third model) to achieve more holistic impacts and/or integrating mobile digital technologies in other, large-scale non-commercial institutions or programmes, such as those of governments and international institutions.

The analysis in Annexe 13 also suggests ways to leverage the three pathways based on more robust problem analysis, assumptions and climate action approaches that are more aligned with the broader evidence base outlined in EQ1. Across the three models, the feasibility and impacts are likely higher when GSMA can support partners to understand the broader systems of climate actors and factors in a given context, and use this to inform their approaches to leveraging mobile digital technologies.

In the following section, we expand on a more systematic approach that GSMA could incorporate to best leverage its strategic position for greater climate impact.

GSMA strategic niche and ecosystem approach

We find that GSMA could best leverage its strategic role and connections to MNOs and mobile digital innovation by adopting a more consistent ecosystems approach to leveraging mobile digital technologies and partnerships. This requires GSMA and its partners to develop a deeper understanding of the relevant climate change actors and factors in a particular context, engage with a broader set of climate organisations and initiatives, and adopt a more explicit and coherent strategic approach to achieving climate change outcomes. Drawing on the analysis presented thus far, we propose the following articulation:

GSMA's strategic position in the climate action ecosystem is to leverage its connections to MNOs and mobile digital innovation to explore, test and scale technologies and partnerships that advance inclusive, meaningful and sustainable mitigation, resilience, NRM and environment outcomes and impacts, particularly for climate vulnerable populations.

Several respondents recognised that GSMA already has a niche in terms of its relationships with and ability to leverage MNOs.¹³⁴ For example, GSMA M4D could leverage work of the GSMA Mutual as well as the Climate Action team and introduce MNOs into new fora such as the UN Conference of the Parties (COP) on biodiversity, where they have, until now, been absent.¹³⁵ This niche is reflected in GSMA's contributions to both generating insights for potential entry points for mobile digital climate technologies, and support for organisations seeking to test these out in practice (for example, through experiments to exploit mobile money and climate finance exchange

¹³⁴ Interviews with 4 expert informants, implicit points in interviews with at least 3 start-ups (BKK, CROP2X, ATEC).

¹³⁵ GSMA M4D Staff notes following COP.

within varied pricing policies¹³⁶ and revenue streams). This niche area is even more relevant following recent cuts to ODA budgets.¹³⁷

Our analysis of the three impact pathways proposed above suggests that GSMA's strategic niche and positioning does and should include supporting all three – commercial, non-commercial and combined uses of mobile digital technology for climate impact. However, the evidence from GSMA's efforts to date, the broader evidence base, and our analysis from this formative evaluation demonstrates that to leverage this strategic position most effectively, GSMA needs to continue to adapt its role and approach.

Its current operating model for leveraging its niche through the M4D climate portfolio focuses on enabling innovative technology, business models, funding and partnerships for commercialisable, scalable approaches that achieve climate outcomes. As discussed earlier, while this has contributed to the innovation, growth and sustainability of numerous businesses developing and deploying mobile digital technologies for climate-related issues, there are limits to what this model has achieved (or could achieve) in terms of meaningful and inclusive climate impacts.

GSMA is well positioned to play an even more catalytic role in climate action ecosystems by building on its strengths and positioning, while incorporating the evidence and insights put forward in this evaluation. Broadly speaking, GSMA should continue to provide support to climate-oriented businesses to analyse, design, iterate and scale mobile digital technology, service offering and financial sustainability. However, to maximise climate impacts, it should put greater emphasis on understanding, engaging, supporting and strengthening context-specific ecosystems of actors and efforts that leverage mobile digital technologies for climate action across commercial, non-commercial and combined pathways.

We illustrate this approach based on GSMA's engagements in Pakistan (see Box 13). For other illustrative cases related to climate finance and carbon credit markets, agriculture and mobile money, and urban utilities, see Annex 10.

Box 13: What an ecosystems approach would look like in Pakistan: aligning Smart Villages and services, climate adaptation for farmers, and early warning systems

The Smart Villages initiative undertaken by the GSMA Digital Utilities team from 2021 demonstrates some important elements of an ecosystem approach. GSMA Mutual and Digital Utilities took a 'thinking and working politically' approach to leveraging strong relationships with the government. The central feature – leveraging the Universal Service Fund (USF) and mobile network operators (MNOs) to provide a package of energy, household and livelihoods services to under-served communities – could lead to more inclusive and meaningful climate change outcomes through leveraging mobile digital technologies. This included explicit analysis and criteria to ensure that selected villages would be feasible for the interventions while advancing inclusiveness in addressing climate change vulnerability. Unfortunately, this approach was interrupted due to political instability. However, it could be revisited and expanded to include GSMA's other core partners and approaches in Pakistan. It would be possible to bring together other actors and initiatives in the broader climate ecosystem, in order to collectively contribute to strengthening the resilience of Smart Villages in ways that are meaningful and inclusive.

In particular, GSMA could replicate successful approaches to leveraging relevant government policy and relationships, and convening donors, government actors, MNOs, civil society organisations (CSOs) and universities as it has done in the AI Forest Fires and EW4All initiatives. GSMA could seek to connect both Agritech partners (such as BKK and Crop2X) and partners working on early warning systems (including

¹³⁶ KII expert informant.

¹³⁷ This niche's implementation is well-evidenced – combining tech efficacy for climate resilience with financing in a learning-driven innovation model – and is exemplified in M4H's recent Innovation Fund Round 5 learning agenda on anticipatory action.

WFF, LUMS and Buraq) around the Smart Villages to support adaptation in a more participatory and holistic way. A broader and more representative set of ecosystem actors – potentially including international organisations (e.g. the Food and Agriculture Organization of the United Nations, FAO),¹ local government, farmers' associations, women's groups, and other CSOs – could co-create more inclusive, meaningful and holistic climate resilience plans, leveraging but going beyond the mobile digital services provided by GSMA's partners.

GSMA could build on its engagement to date – scanning for potential partners and entry points, convening and connecting MNOs, social innovators and public sector actors, and funding and supporting innovation and scaling. It could undertake or support further analysis of the challenges and opportunities of an expanded Smart Villages approach to achieve more meaningful, inclusive and sustainable climate resilience outcomes, including governance and institutional dynamics. It could convene a broader set of its partners through a similar approach to the Digital Urban Utilities forums. Furthermore, it could continue to broker funding for further innovation and scaling, while providing technical assistance to improve and align mobile digital technologies for more holistic climate change adaptation. Finally, it could support long-term integrated assessment and research to understand the outcomes for individuals (disaggregating by gender, age, socioeconomic status, etc.) and communities. This would also help develop a deeper understanding of the enabling and constraining factors in a given context. It would also generate emerging insights to inform ongoing adaptations and to fill gaps in the evidence base around leveraging mobile digital technologies for more holistic climate change approaches (as highlighted in EQ1).

Co-creating a Pakistan country strategy would enable GSMA to undertake and/or support analysis, connection and alignment towards shared climate change outcomes, as suggested above. This could also connect to a potential future Pakistan Climate and Development Country Platform,¹ which would seek to align resources and initiatives towards more strategic and ambitious outcomes, to further ensure the relevance and coherence of GSMA's country engagement. This work should be aligned with GSMA Mutual's ongoing advocacy around reforms related to Pakistan's digital intentions.¹³⁸

3.3.3 Strategic and implementation adjustments to maximise impact

In this final subsection we outline strategic shifts GSMA could undertake to maximise its contribution to inclusive, meaningful and sustainable climate impacts to address EQ3.3: *What strategic and implementation adjustments would be needed to realise this impact?*

This includes an overview of a potential strategic approach as well as concrete recommendations.

EQ3.3 headline conclusion: GSMA should make adjustments to its strategic approach and implementation aligned with an ecosystems approach. It should build on and deepen its existing niche, practices and strengths to understand, connect, support and strengthen climate tech businesses, MNOs and other actors to leverage mobile digital technologies for meaningful, inclusive and sustainable climate impacts. We propose recommendations to help GSMA enable and embed this approach.

The broader evidence outlined in EQ1 highlights the complex actors and factors in the systems that underpin climate change vulnerabilities, enable or constrain climate actions, and shape climate outcomes. It suggests the need to analyse and understand factors in three key realms: the structural and technological; the social, economic and political; and the individual. It also requires a deep understanding of the enabling and constraining factors related to political economy, governance and institutional dynamics. The evidence also suggests the need for more holistic,

¹³⁸ GSMA (2024) Realising Pakistan's Aspiration to become a Digital Nation

multidimensional approaches. These should be inclusive and participatory to meaningfully engage local actors (particularly vulnerable groups and communities, and/or the groups or organisations that represent them).

The evidence and insights presented thus far suggest that GSMA should adopt an ecosystems approach to leveraging mobile digital technologies. This would mean that GSMA and its partners should emphasise, in all aspects of their work:

- the complexities of the problems and challenges contributing to climate change vulnerability and constraining climate change mitigation and sustainable NRM;
- characteristics of the populations and groups being targeted, as well as specific factors affecting them, along with other relevant ecosystem actors;
- meaningful, inclusive and sustainable climate outcomes, and how to track and assess them over time.

There are elements of the ecosystem approach in some of GSMA's engagements – for example, the brokering undertaken through the Digital Utilities team to bring together actors around the Smart Villages initiative in Pakistan (see Box 2). Similarly, some GSMA partners have already adopted more of an ecosystem approach in terms of engaging broader actors and contributing to more holistic climate actions, including examples such as Lersha in Ethiopia (see Box 6). This has often contributed to more promising climate change outcomes, despite the limitations of the commercial impact pathway discussed earlier. Thus, there are efforts and lessons that GSMA could build on to shift towards a more consistent ecosystem approach.

This ecosystems approach can build on and deepen GSMA's existing role, practices and strengths to understand, connect, support and strengthen climate tech businesses, MNOs and other actors to leverage mobile digital technologies for meaningful, inclusive and sustainable climate impacts. By this, we mean:

- **Understanding:**
 - Support and facilitate assessment and analysis of key elements of the ecosystem: the systems that underpin climate change and the vulnerabilities of target populations; the challenges to sustainable NRM; the barriers to expanded renewable energy; and the factors that enable or constrain climate change outcomes (including regulatory and policy issues). Analysis should include: structural/technological factors; social, economic and political (governance and institutions) factors; and individual/behavioural factors.
 - Contribute assessment and insights about potential entry points for leveraging mobile digital technologies, including contextualised analysis of use cases and existing experiments in climate change ecosystems.
 - Develop more explicit, evidence-based and contextualised theories of change for programmes and geographies.¹³⁹
- **Connecting:**
 - Scan and identify potential opportunities and alignment among MNOs, social enterprises, government entities, civic actors representing or working closely with target vulnerable groups and populations, and other relevant climate ecosystem actors.
 - Lead (or support other actors better positioned to do so) convening and brokering involving MNOs, climate technology providers and the broader ecosystem of climate actors to explore and advance collaborative and complementary approaches.

- **Supporting:**

¹³⁹ For a useful ToC resource, see: <https://socialimpact.com/introducing-the-toc-workbook/>

- o Direct funding for co-creation, innovation, scaling, integrating and adapting mobile digital technologies and strategies aligned with broader climate action approaches.
- o Support the development of business and financing models for mobile digital climate technologies.
- o Connect mobile digital technologies and ecosystem actors to other funding, including (but not restricted to) carbon markets, MNO ESR, public–private partnerships, etc.
- **Strengthening:**
 - o Provide technical assistance and other capacity-strengthening support to mobile digital start-ups and other actors seeking to leverage mobile digital climate technologies (including assessing the vulnerabilities of target groups, challenges and constraints to leveraging mobile digital, leveraging mobile digital in more holistic climate action approaches, etc.).
 - o Connect actors and services in a more holistic approach, aligned with a more coherent and co-created strategy for achieving climate change outcomes.
 - o Enable collective learning and adaptation¹⁴⁰ among ecosystem actors involved in leveraging mobile digital technologies:
 - use embedded, participatory approaches to identify and track intermediate and longer-term climate change outcomes;
 - undertake impact evaluations that capture the full effects of interventions on producers and consumers;
 - facilitate shared spaces for reflection on progress and challenges;
 - carry out case studies of initiatives that use participatory methods and explore what, why and how mobile digital technologies and businesses (and others in the ecosystem) contributed to impacts and outcomes for vulnerable groups; share the findings with other partners in the ecosystem.

3.4 Recommendations

Based on the evidence and the findings of the evaluation team, we present recommendations on how GSMA can leverage its niche, and the progress already made in various partnerships and contexts, to deepen and sustain the impacts of its climate initiatives. Our findings recognise that GSMA’s current ways of working are influenced by donor mandates and incentives, and so we include a set of recommendations for FCDO.

For FCDO

1. Review and update GSMA Strategic Partnership (SP)3 with respect to the M4D climate portfolio

The strategic findings of this evaluation will need to be discussed and agreed with FCDO in the context of the new SP3. We recommend the following actions:

a. *Review and update the SP3 theory of change*

GSMA and FCDO should engage in an open and evidence-based discussion about the strategic logic underpinning the M4D climate portfolio and make sure that this is captured

¹⁴⁰ The Collaborating, Learning and Adapting (CLA) approach could be a useful one for GSMA to explore, see: <https://www.resonanceglobal.com/blog/how-does-collaborating-learning-adapting-cla-improve-development-and-sustainable-impact-work>

in the SP3 ToC. This dialogue should be ongoing at the portfolio and priority country levels (see below) to arrive at a robust and shared understanding of how GSMA's strategies, partnerships and projects are best positioned to contribute to meaningful climate impacts, maximising value for money.

b. Review and update SP3 key performance indicators

GSMA and FCDO should review the KPIs for SP3 to ensure that they strike the right balance between political accountability and consistency with effective strategic approaches and ways of working. To mitigate for the possibility of current KPIs failing to incentivise GSMA learning, we recommend exploring a new indicator on the quality of learning and adaptation, undertaken by GSMA directly and facilitated for GSMA partners.

c. Agree on SP3 priority geographies

This evaluation finds that GSMA's strategic positioning and potential for impact are strongest when focused on understanding and engaging a specific and contextualised ecosystem of mobile digital and climate actors and factors. This strongly suggests a relative rebalancing of focus towards priority geographies (countries, or in some cases cities), which should be agreed with FCDO in the context of SP3.

d. Align resource allocation for research and innovation to priority geographies

Consistent with a more geographically focused approach, GSMA and FCDO should agree on a distribution of resources for innovation that will enable greater contextual focus and longer-term support for a strategic set of climate issues, partners and technologies. Resources for research and insights should also be aligned to inform and learn from more deeply contextualised climate innovation.

e. Strengthen engagement and support from FCDO country offices in priority geographies

FCDO country offices should proactively support GSMA to make and/or strengthen linkages to relevant actors in the climate ecosystem (national and subnational government, international organisations, other FCDO projects/grantees/partners, etc.), as well as convening relevant spaces or processes.

For GSMA management

2. Target priority geographies

This evaluation finds that GSMA's strategic positioning and potential for impact are strongest when focused on understanding and engaging a specific and contextualised ecosystem of mobile digital and climate actors and factors. This strongly suggests a relative rebalancing of focus towards priority geographies. We recommend the following actions:

a. Select priority countries based on alignment, opportunity and need

GSMA (in consultation with FCDO) should agree on criteria for priority countries (or even cities) that balance strategic alignment, opportunities (based on partnerships or other entry points), and extent of climate change vulnerabilities. These criteria should be used to priorities a select number of geographies for a more focused ecosystem engagement.

b. *Align resources to deepen support in priority geographies*

GSMA should align resources consistent with this geographic prioritisation to support meaningful understanding, engagement, support and strengthening of selected ecosystems. This should include adequate staffing for priority geographies.

c. *Align and leverage all parts of GSMA (Mutual, Foundation, etc.)*

Ensure that all parts of GSMA are coordinating and aligning around strategic objectives in priority geographies, including the enabling environment for mobile digital.

3. **Articulate, adopt and integrate GSMA essential principles for effective partnerships**

Given the importance of partnerships to GSMA's niche, role and positioning, it should develop a set of principles to inform its partnership approach and practices, exploring (and possibly adapting) the principles of the Digital Impact Alliance.¹⁴¹

4. **Adapt the Innovation Fund**

The evaluation suggests that adapting the Innovation Fund would make it more effective in supporting the partners and innovations that are most likely to contribute to inclusive, meaningful and sustainable climate change impacts. We recommend the following actions:

a. *Update selection criteria based on priority countries and evidence of effective approaches*

The Innovation Fund should adapt its selection criteria to align with an ecosystem approach. This includes both greater emphasis on funding priority geographies (see recommendation 2) and a more connected and coherent strategy for funding an ecosystem of innovation grantees in those priority geographies. Furthermore, the criteria should reflect the evidence for more effective and impactful approaches, supporting proposals that incorporate a strong analysis of the problem, other stakeholders, and the system they are engaged in. Proposals should have a clear theory of change for achieving climate change outcomes, informing their technology use case, business case, partnerships and overall approach.

b. *Streamline the application and selection process*

The Innovation Fund application process entails significant time and effort for candidates, whether they are successful or not. GSMA should streamline this process as far as possible.

c. *Build more flexibility and learning into grants*

Successful grantees should be able to learn and adapt for the duration of the grant period. The grant structure and MEL processes (indicators and practices) should enable and facilitate this flexibility.

¹⁴¹ The partnership principles from the Digital Impact Alliance include: trust (build confidence for adoption through inclusion, transparency and accountability); people-centred (partnerships and technology focus people and real human challenges, not just technological solutions); outcome-focused (success is measured through shared metrics focused on impact, not just uptake of technology); sustainability (integrating technology into partnerships and systems for relevance, continuity and long-term impacts); country-driven/globally informed (avoid generalised solutions, rather countries prioritise and lead while drawing on global evidence and experience).

5. Clarify and strengthen the MEL system

Consistent, robust and practical monitoring, evaluation and learning systems, indicators and practices are essential to support innovation and impact, and to contribute to the broader evidence base. Despite finding some excellent recently developed frameworks, the evaluation encountered significant evidence gaps across the M4D climate portfolio. This made it challenging to assess what, how and why change was (or was not) happening, particularly around the climate change outcomes and impacts GSMA is working towards. GSMA should invest in an organisation-wide process to develop an MEL system that is fit for purpose, and has buy-in from across the organisation. The process should include identifying and agreeing on priority learning questions at portfolio and programme levels. It should address the need for a strong culture and enabling environment for evaluation and learning, as well as adequate frameworks, resources, roles and practices.¹⁴² We recommend the following actions:

- a. *Strengthen tools and practices for identifying and tracking intermediate and longer-term outcomes.*

For the climate portfolio, priority geographies, and partnerships and projects, GSMA should develop indicators, tools and practices that enable it to identify and track intermediate and longer-term outcomes. One option would be to implement a more consistent, embedded and robust outcome harvesting process that could be developed and integrated across the portfolio. It should aim to identify and track intermediate outcome indicators related to increased integration of carbon markets and offering of financial services (e.g. in numerous Agritech projects) in order to understand the expected and unexpected changes that occur.

- b. *Consider more embedded research and ex-post evaluation*

For major partnerships and (especially) priority geographies, GSMA MEL would benefit from more longitudinal evidence-generation, both to inform adaptation and more robust and evidence-based learning. Embedding research as an element of GSMA's support for partners could generate ongoing evidence that could be shared with other stakeholders to inform continuous learning and adaptation. There is also a need for more consistent ex-post evaluation of the impacts of projects and partnerships that can contribute to a robust evidence base over the medium to long term. Research and evaluation should align with learning and evaluation priorities established for the portfolio, programmes and geographies.

- c. *Adapt MEL for the Innovation Fund and priority geographies*

Ensure that the MEL system is adapted to the different needs of a broader modality, such as the IF, and deeper engagements in priority geographies. This includes articulating learning and evaluation priorities for both programmes and geographies.

For the M4D team

6. Update and strengthen the M4D climate strategy

¹⁴² For example, see: <https://www.fsg.org/resource/building-strategic-learning-and-evaluation-system-your-organization/>

This evaluation suggests that GSMA would benefit from revising its M4D climate strategy. Documents like the Climate Impact Narrative are more descriptive than explanatory. Tools like the Climate Tech theory of change articulate more comprehensive thinking on how GSMA contributes to its overall outcomes, but still rely on significant assumptions that do not fully reflect the available evidence. This evaluation has sought to present evidence and insights that could be incorporated into a clearer, stronger and shared climate strategy to inform the work of the teams implementing the M4D climate portfolio, both at global level and in priority geographies. We recommend the following actions:

a. *Update and clarify climate change outcomes*

The M4D team should update and clarify the climate change outcomes it seeks to contribute to and achieve over the long term, in the areas of mitigation, adaptation and NRM. Definitions should reflect how the desired outcomes are inclusive, meaningful and sustainable. Intermediate outcomes (in terms of relationships, capacities, resources, processes, etc.) at a broader level should also be included.

b. *Update and clarify the overall theory of change*

The climate strategy should be informed by a robust but relatively streamlined ToC, which describes how mobile digital technologies can be leveraged to make a significant contribution to the desired climate outcomes. The ToC should reflect the kinds of challenges and limitations encountered in GSMA's programming and learning, as well as the broader evidence. It should also detail the actors and factors involved in the broader ecosystem, and outline potential pathways to change. Assumptions underlying the ToC should be updated on the basis of evidence and learning, and should be aligned with MEL frameworks to ensure that they are tested and further refined over time.

c. *Develop practical guidance for the implementation strategy*

To bridge strategy and practice, GSMA should develop a short implementation guide for its M4D climate change strategy. This could focus on how to put into practice the strategic role and approach consistent with the overall strategy, referring both to geographically focused ecosystems, but also to other programmes and modalities (such as the Innovation Fund, Digital Utilities, Climate Tech, etc.). It should also reflect and integrate other recommendations on the updated MEL system and approach, and partnership principles.

7. Clarify and strengthen a whole-of-GSMA role and approach in priority geographies

The evaluation found evidence of good practices but also fragmentation in the two country case studies (Kenya and Pakistan, see annexes 6 and 7). There was evidence that politically savvy and well-connected staff played an instrumental role in brokering and connecting that enabled partnerships and joint efforts to get off the ground. There were also cases of teams working in isolation and failing to explore synergies. Overall, there was no consistent and coherent approach to leveraging GSMA's role and resources in a given geography. We recommend the following actions:

a. *Articulate GSMA's approach to engaging with partners and other stakeholders*

The short implementation guide (recommendation 6c) should clarify a consistent, coherent and effective approach for GSMA teams to engage and support entry points in the climate ecosystem, as well as with partners and other stakeholders. This should go beyond GSMA's 'usual suspects' to reach civic actors that represent or work closely with priority vulnerable groups (such as smallholder farmer or fisher associations, Indigenous communities, women's associations, federations representing informal urban-dwellers, etc.). It should also extend to relevant national and subnational government actors, and other international institutions with shared climate change priorities.

b. *Co-create strategies for priority geographies*

○ A geographically focused approach will require a clear and shared strategy. This should be developed with the involvement of diverse GSMA teams, partners and other key stakeholders to maximise shared understanding and ownership, and to guide collaboration towards joint climate change objectives. The core of this strategy should be a contextualised ToC for the priority outcomes (recommendation 6a).¹⁴³ Furthermore, GSMA should explore and potentially connect to larger-scale efforts and funding that could be enhanced or complemented by mobile digital, and efforts that address vulnerabilities or climate actions that are not feasible for core GSMA partners. The strategy should also include:

(1) clear and contextualised climate change outcomes consistent with country and stakeholder priorities, particularly those of vulnerable groups being targeted;

(2) mapping climate change stakeholders in the ecosystem. Where possible, identify associations, federations or other groups that bring together and represent the vulnerable populations GSMA is seeking to benefit, or organisations that have relationships with these groups;

(3) analysis of potential entry points, drivers of vulnerability, constraints and barriers to advancing climate outcomes, and other governance and institutional factors;

(4) a country-specific MEL approach, including intermediate and longer-term indicators, and learning and evaluation priorities, partnerships and modalities;

(5) funding and partnership support to advance the strategy.

8. Clarify and strengthen the approach of the Digital Utilities programme

The evaluation found significant strengths in the Digital Utilities programme, particularly its role in brokering collaborations and partnerships among government and private sector actors around developing and scaling mobile digital technologies. However, some programme partners did not have clear evidence of (or an adequate approach for) achieving inclusive, meaningful and sustainable climate change outcomes. In the context of updating and strengthening the M4D climate strategy and practical approach (recommendation 6c), there is an opportunity for GSMA to both draw on and strengthen lessons and practices from the Digital Utilities programme. We recommend the following actions:

a. *Clarify and strengthen alignment with climate outcomes and vulnerable populations needs*

¹⁴³ For a useful resource, see: <https://socialimpact.com/introducing-the-toc-workbook/>

In alignment with geographically focused strategies, the Digital Utilities programme should clarify its climate change outcomes and approaches of priority utilities and partnerships. It should set out more explicit and consistent objectives and approaches to ensuring that service delivery systems are resilient and inclusive – progressively improving access for people in under-served informal urban areas.

b. *Deepen analysis of service challenges and gaps*

In alignment with the short implementation guide for the M4D climate change strategy (recommendation 6c), the Digital Utilities programme should develop a stronger analytical approach to understanding challenges and gaps in service delivery priorities in a given context. This should address political economy, institutional and governance issues related to inclusive services to vulnerable groups.

c. *Clarify and strengthen partners' strategies for achieving inclusive climate outcomes*

Informed by stronger analysis, and in alignment with M4D and geographically focused strategies, partnership and implementation approaches, the Digital Utilities programme should support partners to clarify and strengthen their approach to achieving climate outcomes, including for vulnerable population groups.

d. *Develop guidance for brokering and convening, including more intentional engagement with civic actors embedded in and/or representing vulnerable urban populations*

Given the Digital Utilities team's extensive and often successful brokering activities, the team should develop guidance on how to convene and connect that others can use. This should include how to consult and collaborate with civic groups that represent or working closely with informal communities or other priority population groups. This guidance can be integrated into M4D strategic implementation guidance and modalities, and used across Digital Utilities' engagement in priority geographies.

9. Strengthen insight work

The evaluation suggests that there is an opportunity to strengthen the reach, uptake and influence of GSMA insight efforts. This would involve exploring the relatively low usage rates of Insight reports, to inform the development of an explicit outreach approach for each individual report. There should be greater emphasis on engaging stakeholders (including all GSMA teams and partners) and other audiences when developing evidence and recommendations for insight reports, to strengthen buy-in and outreach. The evidence used to inform insight reports and case studies should be clarified and strengthened.

10. Focus and strengthen engagement in the Pakistan climate ecosystem

Based on the case study developed for this evaluation (see Annexe 7), we recommend that GSMA explores potential for re-engaging the Smart Villages programme. This should include mapping and engaging with other actors and efforts in the broader climate ecosystem, and aligning GSMA's current and future partnerships and support with this. If initial explorations are promising, this could be incorporated as an entry point in a Pakistan country strategy.

11. Focus and strengthen engagement in the Kenya climate ecosystem

Based on the case study developed for this evaluation (see Annexe 6), we recommend that GSMA explore alignment between Safaricom, 4R Digital's CaVEx platform, community forestry associations and World Vision Kenya around carbon markets and sustainable NRM. If initial explorations are promising, this could be incorporated as an entry point in a Kenya country strategy.

Annexes

Annexe 1: GSMA documentation and other literature reviewed

The evaluation team reviewed large quantities of internal GSMA programme and project documentation as part of this case study – a full list is [accessible here](#). We have listed below all internal and external documentation referred to directly in this case study report.

1	Adam Smith International. COP29, Pakistan's climate crossroads and the urgency for climate finance.
2	AP News (September 2023). As Africa opens a climate summit, poor weather forecasting keeps the continent underprepared
3	Aquarech CRA Fund Final Reporting 2.0.pdf
4	Aurora. (2025). DawnMedia Delivers on its Call for Collective Climate Action - Aurora
5	Awi Ellie. (2023). The State of IoT in Kenya. Medium
6	Biegon et al. 2024. Budget Adaptation? What we know about how Kenya's budget is evolving to tackle climate adaptation. Bajeti Hub and Institute of Public Finance.
7	Business and Human Rights Resource Centre. (2021). Kenya: Survey reveals private firm sharing clients' data with third parties without consent; Safaricom takes measures to curb unlawful data sharing
8	Digital Impact Alliance. Principles for Digital Development.
9	FSG. Building a Strategic Learning and Evaluation System for Your Organization
10	Government of Kenya (2023). National Climate Change Action Plan (Kenya) 2023-2027. Ministry of Environment, Climate Change and Forestry, Nairobi, Kenya.
11	Government of Kenya, Ministry of Environment, Climate Change and Forestry, Nairobi, Kenya. (2023). National Climate Change Action Plan (Kenya) 2023-2027.
12	Government of Kenya. National Climate Change Action Plan 2018-2022 Second Implementation Status Report for the FY 2019/2022
13	Government of Pakistan. Pakistan National Action Plan 2023
14	GSMA (2021). The Role of Digital and Mobile-Enabled Solutions in Addressing Climate Change

15	GSMA (2022). The state of mobile-enabled climate technology in Indonesia
16	GSMA (2023). Climate change adaptation and livelihood restoration in Tana River Delta
17	GSMA (2023). Emerging Trends in Climate Tech Innovations: The GSMA Innovation Fund for Climate Resilience and Adaptation.
18	GSMA (2023). GSMA Mobile for Development Climate Impact Narrative
19	GSMA (2023). The GSMA Innovation Fund for Climate Resilience and Adaptation: Portfolio overview
20	GSMA (2023). The GSMA Innovation Fund for Digital Urban Services: Portfolio overview
21	GSMA (2023). The GSMA Innovation Fund Process Evaluation Final Report, Picture Impact, May 2023.
22	GSMA (2024) Private Sector Partnerships for Scale Learning Document
23	GSMA (2024) Realising Pakistan's Aspiration to become a Digital Nation
24	GSMA (2024) Realising Pakistan's Aspiration to become a Digital Nation
25	GSMA (2024). Announcing the GSMA Innovation Fund for Anticipatory Humanitarian Action Cohort.
26	GSMA (2024). Building a national circular supply chain platform – ReCircle's ClimaOne platform in India
27	GSMA (2024). Combatting forest fires with AI in Pakistan.
28	GSMA (2024). Digitising Agriculture and Unlocking Finance in Ethiopia: Lersha
29	GSMA (2024). Digitising Agriculture in Nepal: GeoKrishi
30	GSMA (2024). Five steps to measuring environmental impact of climate tech innovation
31	GSMA (2024). Realising Pakistan's Aspiration to become a Digital Nation
32	GSMA (2024). Strengthening Climate Resilience in Nigeria through Digital Market Hubs: CoAmana
33	GSMA (2024). The GSMA Innovation Fund for Climate Resilience and Adaptation Cohort 2.0 announcement
34	GSMA (2025). Leveraging Digital Technology for Climate-Smart Farming in Pakistan: BKK.

35	GSMA (2025). Partnering with CARE Kenya on digitising emergency response to drought and food insecurity
36	GSMA (2025). Transforming Somaliland's Frankincense Supply Chain with Blockchain.
37	GSMA Aquarech Environmental Assessment Report.
38	GSMA CR BKK Baseline Report
39	GSMA Email: COP16 - The download.eml
40	GSMA Innovation Fund For Climate Resilience and Adaptation Final Reporting – AQUARECH LTD June – 2024.
41	<u>GSMA M4H 2024 Annual Report</u>
42	GSMA Mapping resilience: Participatory digital mapping for mangrove conservation
43	<u>GSMA. (2021) Mobile Technology for Participatory Forest Management: Co-designing and testing prototypes in Kenya Mobile for Development</u>
44	<u>GSMA. (2022) Mobile for Humanitarian Innovation Annual Report</u>
45	<u>GSMA. (2022). Catalysing Partnerships in Plastics - Exploring the Potential for Collaboration between Mobile Network Operators and Plastics Organisations</u>
46	<u>GSMA. (2025) Highlights from the GSMA Digital Urban Utilities Forum on Waste Management in Nairobi Mobile for Development</u>
47	<u>GSMA. (2025). Kenya's Digital Economy to Contribute KSH 662 Billion to GDP by 2028, Driven by Policy Reforms - Newsroom</u>
48	<u>GSMA. (2025). Leveraging Digital Technology for Climate-Smart Farming in Pakistan: BKK Mobile for Development</u>
49	<u>GSMA. (May 2023). Climate change adaptation and livelihood restoration in Tana River Delta: Embracing innovative approaches and technology</u>
50	GSMA. Altai Round 6 Portfolio Review.
51	<u>GSMA. Aquarech CRA Fund Final Reporting</u>
52	<u>GSMA. Aquarech endline report</u>

53	GSMA. Buraq Integrated Solutions Mobile for Development
54	GSMA. Crop2X Mobile for Development
55	GSMA. Farm To Feed Mobile for Development
56	GSMA. FCDO 2024 AR and M4H donor KPI reporting spreadsheets.
57	GSMA. ICF reporting for financial year 2023-24 (List of ICF reporting FY23-24 GSMA – updated.xlxs).
58	GSMA. Jazz Pakistan Mobile for Development
59	GSMA. M4H Learning plan for the Anticipatory Resilience Innovation Fund round.
60	GSMA. Outcome Harvest Learning report based
61	GSMA. Pressure on urban services
62	GSMA. Smart Village Pakistan Outcome Map: reference the associated PowerPoint Slide #12.)
63	GSMA. Synnefa Mobile for Development
64	GSMA. UjuziKilimo Mobile for Development
65	https://www.gsma.com/about-us/regions/asia-pacific/gsma_resources/digital-nation-pakistan
66	<i>Ibrahim Kipngeno Rotich, Hilda Chepkirui, Peter K. Musyimi. (2024). Renewable energy status and uptake in Kenya. Energy Strategy Reviews Volume 54, 101453, ISSN 2211-467X. https://doi.org/10.1016/j.esr.2024.101453. (https://www.sciencedirect.com/science/article/pii/S2211467X24001603)</i>
67	ICNL. 2024. Pakistan Civic Freedom Monitor.
68	International Energy Agency (IEA). Kenya Country Profile, Where does Kenya Get its electricity?
69	International Growth Centre. (2024). Climate action and political economy in Pakistan
70	International Organization for Migration Kenya Country Office, 2023. Analysis of Human Mobility in the National and County Climate Change and Disaster Risk Reduction Frameworks in Kenya. IOM, Kenya.

71	<u><i>Kenya - Country Climate and Development Report : Digital Sector Background Note (English).</i></u> <u>Washington, D.C. : World Bank Group.</u> <u>http://documents.worldbank.org/curated/en/099111523061542518</u>
72	<u><i>Kenya ICT Authority. The Government Enterprise Architecture Framework</i></u>
73	<u><i>Kenya Ministry of Information, Communications and Technology, Kenya. 2019. National Information, Communications and Technology (ICT) Policy.</i></u>
74	<u>KMD. 'State of the Climate Kenya 2023'. Kenya Meteorological Department, 2023.</u>
75	M. Bilal Farooq. (May 2023). <u>Climate-Tech Startups Shaping Pakistan's Future https://propakistani.pk/</u>
76	<u>GSMA Intelligence (2022). Making Digital Pakistan a reality</u>
77	<u><i>Matthew Tyce, Beyond the neoliberal-statist divide on the drivers of innovation: A political settlements reading of Kenya's M-Pesa success story, World Development, Volume 125, 2020, 104621, ISSN 0305-750X, https://doi.org/10.1016/j.worlddev.2019.104621.</i></u>
78	Melissa Leach, John Gaventa and Katy Oswald (2017). <u>Engaged Excellence</u> . IDS Bulletin Volume 47 Number 6.
79	<u><i>Ministry of Environment and Natural Resources. (2017) Kenya National Adaptation Plan 2015-2030 United Nations Network on Migration</i></u>
80	<u><i>Mobile Connectivity Index for Kenya</i></u> <u>https://www.mobileconnectivityindex.com/index.html#year=2023&zoneIsocode=KEN&analysisView=KEN</u>
81	<u>ND-GAIN Country Index https://gain.nd.edu/our-work/country-index/rankings/</u>
82	ND-GAIN. <u>Notre Dame Global Adaptation Initiative. Rankings</u>
83	<u>NDMA Pakistan (2025). National Disaster Risk Reduction Strategy 2025 – 2030, Pakistan. National Disaster Management Authority, Islamabad, Pakistan.</u>
84	<u><i>Njuguna, E.; Mburu, J.; Birner, R.; Daum, T. Kenya's farmers have lots of digital tools to help boost productivity – how they can be made more effective. The Conversation. (accessed 2025-03-01).</i></u>
85	ODI (2024). <u>Freetown Waste Transformers: A study of private sector innovation in the waste management sector in Africa.</u>
86	<u><i>Omala, M. A., Kioko, E., & Gravesen, M. (2024). Effective climate finance coordination? Stakeholder perceptions, climate change policy implementation and the underlying political economy factors in Kenya. Climate Policy, 24(7), 863–877.</i></u>

87	Pakistan Ministry of Climate Change (2017). Pakistan: Climate Adaptation Technology Action Plans & Ideas
88	Pakistan Ministry of Climate Change (2017). The Transformative Role of Information Technology in Pakistan - Stratheia,
89	Pakistan Ministry of Climate Change (2021), National Climate Change Policy
90	Pakistan Ministry of Energy. Energy Efficiency & Conservation Strategic Plan 2020-23 by National Energy Efficiency and Conservation Authority NEECA - Climate Change Laws of the World
91	Peixoto, Tiago; Fox, Jonathan. 2016. When Does ICT-Enabled Citizen Voice Lead to Government Responsiveness?. WDR 2016 Background Paper;. © World Bank. http://hdl.handle.net/10986/23650 License: CC BY 3.0 IGO.
92	Radio Pakistan. (2024) Pakistan unveils first National Climate Finance Strategy
93	Resonance Global. Collaborating, Learning and Adapting (CLA) approach
94	Revised Pakistan 2022 Floods Response Plan Final Report (Issued 15 Dec 2023) OCHA
95	Simon Kodiaga, Afrobarometer (2023). AD696: Kenyans want more government action to fight climate change, and stand ready to help
96	Siri Eriksen, E. Lisa F. Schipper, Morgan Scoville-Simonds, Katharine Vincent, Hans Nicolai Adam, Nick Brooks, Brian Harding, Dil Khatri, Lutgart Lenaerts, Diana Liverman, Megan Mills-Novoa, Marianne Mosberg, Synne Movik, Benard Muok, Andrea Nightingale, Hemant Ojha, Linda Sygna, Marcus Taylor, Coleen Vogel, Jennifer Joy West. (2021). Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? World Development, Volume 141 https://doi.org/10.1016/j.worlddev.2020.105383 .
97	SOAS. (2022). Pakistan: An interesting paradox of growth without development
98	State Bank of Pakistan. Financial Inclusion: Financial Literacy & Capacity Building
99	Statista. Share of mobile subscriptions by operator in Kenya from 2018 to 2020, by quarter https://www.statista.com/statistics/1064148/mobile-market-share-kenya/
100	The Nation. (2025). Mobile-powered Early Warning Systems key to disaster preparedness: Jazz CEO
101	UK FCDO (2020). FCDO Ethical Guidance for Research, Evaluation and Monitoring Activities
102	UK FCDO (2024). M4D Annual Review 2023.

103	UK FCDO. M4D - Mobile for Development Strategic Partnership DevTracker Programme GB-1-203804
104	UK FCDO. M4D 2023 Annual Review.
105	UK FCDO. M4D Annual Review Report 2024
106	UK FCDO. M4H - Mobile for Humanitarian: Exploring the use of mobile technology to provide life-enhancing services during humanitarian response, recovery and preparedness. DevTracker Programme GB-GOV-1-300446
107	UK FCDO. M4H Annual Review report 2024
108	UK Government (2024) The Kew Lecture: Foreign Secretary's speech on the climate crisis
109	UN OCHA (2023). Revised Pakistan 2022 Floods Response Plan Final Report
110	United Nations Kenya. (2021). How UNDP and the Kenyan government are collaborating to restore ecosystems
111	United Nations. (2015) Sendai Framework for Disaster Risk Reduction 2015-2030.
112	World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series;. © World Bank, Washington, DC. http://hdl.handle.net/10986/38277 License: CC BY-NC-ND.” World Bank Document
113	World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series;. © World Bank, Washington, DC. http://hdl.handle.net/10986/38277 License: CC BY-NC-ND. ” World Bank Document,
114	World Bank Group. 2023. Kenya Country Climate and Development Report . © Washington, DC: World Bank. http://hdl.handle.net/10986/40572 License: CC BY-NC-ND 3.0 IGO.
115	World Bank. (2023). Turning Concern into Action: Understanding Climate Change Attitudes in Pakistan
116	World Bank. (2024). Financial Inclusion in Sub-Saharan Africa—Overview
117	Zong. Corporate Social Responsibility - Zong 4G Pakistan

Annexe 2: Evaluation respondents

Name	Title	Organisation	Respondent type	Interaction
Michael Unwin	Strategic Partnerships Lead - Technology & Innovation FCDO	UK FCDO	Donor	Casual conversation
Annalena Fuchs	Scaling Digital Agriculture Innovations through Start-ups (SAIS)	GIZ	Donor	Key informant interview
Nadeem Ahmed	Policy Manager, Climate Change	FCDO Pakistan	Donor	Key informant interview
Luisa Odell	Innovation and Technology Advisor	FCDO	Donor	Key informant interview
Phil Outram	Tech and innovation adviser	FCDO	Donor	Key informant interview
Josef Noll	Professor at the Department of Technology Systems,	University of Oslo & Secretary General of the Basic Internet Foundation	Expert	Key informant interview
Linda Raftree	MERL Tech Initiative Founder	MERL Tech	Expert	Key informant interview
Howard Standen	ODI. On leave of absence from FCDO where he is in RED working on Agriculture; Climate Change; Conflict; EWS	ODI/FCDO	Expert	Key informant interview
Peter Evans	Independent Consultant. Formerly FCDO Research and Evidence Division	Independent	Expert	Casual conversation
Chris Addison	Consultant works for FAO Digital; CTA etc	Independent expert	Expert	Key informant interview
Blane Harvey	Associate Professor	MacGill University	Expert	Casual conversation, Reviewer of literature review
Thomas Tanner	Professor of Climate and Society at SOAS University of London. Serves on the expert advisory body for the UN's Race to Resilience initiative.	SOAS University of London	Expert	Casual conversation, Email exchanges
Monica Nthiga	Freelance tech, governance and humanitarian consultant	Formerly Regional Director - Eastern and Southern Africa Humanitarian OpenStreetMap and Ushahidi	Expert	Key informant interview
Sobia Khan	Corporate Communication Expert	Universal Service Fund (USF) Pakistan	Government	Key informant interview
Dickson Ayuka	Cofounder	Ujuzi Kilimo	Grantee	Key informant interview
James Odede	Cofounder and CTO	Aquarech	Grantee	Key informant interview
Jon Ridley	Cofounder and Director	4R Digital	Grantee	Key informant interview
Leah Wangu	Grants Coordinator	Synnefa	Grantee	Key informant interview

Marc Decunha	GSMA Project Manager	Farm to Feed	Grantee	Key informant interview
Junaid Yamin	Co-Founder and CEO	WeatherWalay	Grantee	Key informant interview
Fozia Hussain	Senior Manager projects and partnerships	BKK Grantee/ WeatherWalay	Grantee	Key informant interview
Humaira Rana	Project Manager	CROP2X Grantee	Grantee	Key informant interview
Muhammad Asad	Director Operations	Buraq Integrated Solutions (Pvt) Limited	Grantee	Key informant interview
Leah Wangu	Grants Coordinator	Synnefa	Grantee	Key informant interview
Asaminew Alemayehu	Field Office Coordinator	Tearfund	Grantee	Casual conversation
Frank Annor	CEO	TAHMO	Grantee	Casual conversation
Dickson Ayuka	CCO	Ujuzi Kilimo	Grantee	Key informant interview
Richard Appiah	Sales & Marketing Specialist	Sommelife	Grantee	Casual conversation
Michael Ogundare	CEO & Co-Founder	Crop2Cash	Grantee	Key informant interview
Natalie Casey	Chief Business Officer	Koolboks	Grantee	Key informant interview
Dickson Marira	CEO	Wonderkid	Grantee/Partner	Key informant interview
Alfred Osiko	Senior Market Engagement Manager, Climate Tech	GSMA	GSMA Staff	Key informant interview
James Karanja	Monitoring & Evaluation Analyst	GSMA	GSMA Staff	Key informant interview
Samir Hafiz	Climate Monitoring, Evaluation and Learning Manager, London	GSMA	GSMA Staff	Key informant interview, Focus group, Sensemaking session
Bilal Qureshi	Digital Inclusion, Innovation and Impact Investment	GSMA Pakistan	GSMA Staff	Key informant interview
Mirza Muhammad Zohaib	Innovation Fund Manager (APAC)	GSMA Pakistan	GSMA Staff	Key informant interview
Nigham Shahid	Senior Insights Manager, Central Insights Unit	GSMA London	GSMA Staff	Key informant interview
Saira Faisal	Country Lead Digital Transformation, Asia Pacific, Pakistan	GSMA Asia Pacific	GSMA Staff	Key informant interview
George Kibala Bauer	Senior Director, Climate Tech and Digital Utilities	GSMA London	GSMA Staff	Key informant interview, Sense making session
Muhammad Arham Shoukat	Former Market Engagement Manager Pakistan	ex-GSMA Pakistan	GSMA Staff	Key informant interview
Kimberley Brown	Head of Mobile for Humanitarian Innovation	GSMA	GSMA Staff	Key informant interview

Gregory Omondi	Senior Manager Innovation Fund	GSMA	GSMA Staff	Casual conversation
Praveen Menon	Innovation Fund and Operations Director	GSMA	GSMA Staff	Casual conversation
Phillipe Bellordre	Head of Operations and Innovation Fund	GSMA	GSMA Staff	Casual conversation
Akanksha Sharma	Head of Climate Tech and Digital Utilities programmes	GSMA	GSMA Staff	Key informant interview, Focus group, Sensemaking session
Leila Guici	Senior Advocacy Manager – Climate Tech	GSMA	GSMA Staff	Key informant interview, Focus group, Sensemaking session
Zoe Hamilton	Senior Research Manager	GSMA	GSMA Staff	Key informant interview
Bhavik Doshi	Monitoring and Evaluation Manager, AgriTech	GSMA	GSMA Staff	Key informant interview
Zach White	Senior Insights Manager, Digital Utilities	GSMA	GSMA Staff	Key informant interview, Focus group
Chelsea McKeivitt	Monitoring and Evaluation Manager, GSMA Innovation Fund	GSMA	GSMA Staff	Key informant interview
Hector Matthews	Monitoring, Evaluation and Learning (MEL) Manager, Mobile for Humanitarian Innovation	GSMA	GSMA Staff	Key informant interview, Focus group, Sensemaking session
Bryce Hartley	Senior Manager: Strategic Partnerships and Market Engagement	GSMA	GSMA Staff	Key informant interview
Anna Colquhoun	Senior Insights Manager, Climate Tech	GSMA	GSMA Staff	Key informant interview, Focus group
David Kleipterp	Co-Head of Investments	Untapped Global	Investor	Casual conversation
Cutie Mireku	Manager Fintech Business Development (SME & Govt)	MTN Ghana	MNO	Casual conversation
Valentine Cheruiyot & James Otemba	Manager - Climate and Environmental Management	Safaricom	MNO	Key informant interview
Taimoor Hassan	Head Digital Products & Growth	Jazz Pakistan	MNO	Key informant interview
Muneeb Khan	Head of Digital Analytics and Strategy	Jazz Pakistan	MNO	Key informant interview
Salman Iqbal	Manager Usability and Design	Jazz Pakistan	MNO	Key informant interview
Anayat Khan Swati	Field Coordinator	WWF	NGO	Key informant interview
M Waseem Khan	Manager	WWF	NGO	Key informant interview

Muhammad Ibrahim Khan	Director	WWF	NGO	Key informant interview
Mary Ngecha	Founder	Taka Taka ni Mali	Partner	Key informant interview
Ali Akbar Abbas	Business Development Manager	WIT LUMS	Partner	Key informant interview
Babar Sahib Din	CEO	LWMC	State Owned Enterprise (SOE)	Key informant interview
Shoaib Dar	Head of Operations and HOD Control Room	LWMC	State Owned Enterprise (SOE)	Key informant interview

Annexe 3: Evaluability assessment

Our light-touch assessment aimed to answer a central question: *How evaluable is the GSMA climate strategy and portfolio?*¹⁴⁴

We considered the following aspects:

A. In theory:

- i) How evaluable are the GSMA Climate Tech theory of action (ToA) and theory of change (ToC): is there a clear problem analysis and rationale for interventions?
- ii) Are beneficiaries clearly identified?
- iii) Is there a theory of change with inputs, activities, reach, outputs, outcomes, impacts (specified or expected to be emergent) and proposed causal linkages between them clearly indicated?
- iv) Is it possible to identify which linkages in the ToC are least understood or will be most critical to the intervention's success, and thus may inform the focus of the evaluation?
- v) Are assumptions about the roles of actors not directly involved but on whom success depends explicit?

B. In practice: What is the state of implementation and what is the availability of relevant data and the capacity of management systems to provide it?

C. Utility: How useful and practical will the evaluation be, given views and availability of stakeholders?

The evaluability assessment was conducted through a brief high-level review of the most relevant documents, sensemaking exercises with the GSMA monitoring, evaluation and learning (MEL) and programme teams around the ToC, and initial interviews with key staff from several GSMA teams working on climate change as well as FCDO staff supporting GSMA's innovation work.¹⁴⁵

Our evaluability assessment found that:

A. The climate portfolio and theories of action and change are evaluable in theory.

During the inception period we have established a clear understanding of how the M4D Climate Impact Narrative (which reflects the ToA and ToC) came about, what key terms used by GSMA mean, and the nature and boundaries of the evaluation – the climate portfolio.

¹⁴⁴ Overarching questions taken from [Evaluability assessment | Better Evaluation](#); More specific questions adapted from Peersman, G., Guijt, I. and Pasanen, T. (2015) *Evaluability Assessment for Impact Evaluation*. A Methods Lab publication. London: Overseas Development Institute. Though this guide focuses on impact evaluation, questions on theory of change are relevant to formative evaluation

¹⁴⁵ During the inception phase we briefly reviewed key insights reports including synthesis of applications for the climate change innovation, the GSMA Climate Impact Narrative, the Climate Tech team's theory of change diagram, baseline endline and scaling reports for one round of the Innovation Fund, outcome harvest documents shared by the Digital Utilities Team, MEL and Evaluation documents M4H. We had multiple interactions with the Central MEL team (led by Director, Ruth Orbach) and interviewed MEL Managers of the Agritech team (Bhavik Joshi), Climate Tech team (Samir Hafiz), Innovation Fund (Chelsea McKevitt), M4H (Hector Matthews); Senior MEM Climate Tech team (Alfred Osiko), Climate Tech advocacy (Leila Guici), Digital Utilities and Climate Tech Director (Akanksha Sharma), Digital Utilities Director (George Kibala Baure), Senior Insights (Zach White) and FCDO Innovation and Technology team (Phil Otram and Luisa Odell).

Figure 1: M4D Climate Impact Narrative



The GSMA M4D Climate Impact Narrative provides details of GSMA’s problem analysis and rationale for intervention, clearly identifying different intended beneficiary groups at government, sector and community level. Activity types, outcomes and impacts that are being pursued in 17 countries and at the global level are explained. Causal linkages and the importance of other actors in impact success were somewhat implicit at the start of the inception period. We assume that this is partly because the theory and narrative have been developed retrospectively. As such, the narrative provides a heuristic to describe how different initiatives being implemented are expected to contribute to climate outcomes and impacts rather than a working theory that has been used intentionally by M4D to guide strategy and drive learning. Collaborative activities undertaken by the Tap Room team together with GSMA M4D staff during the inception period that included findings from the evaluation’s literature review have started to surface and make causal and contextual assumptions more explicit. At the same time, they have enabled us to identify areas of focus for the formative evaluation that are reflected in the methodological design.

Our current understanding is that GSMA M4D assumes:

- that raising awareness of technological possibilities through its insight outputs and awareness-raising will strengthen the mobile ecosystem and increase its visibility and legitimacy;
- that such legitimacy will enable GSMA to broker/forge relationships between different actors who are increasingly aware of and can see social and commercial benefits of collaborating in partnerships and supporting rollout of these technologies to address climate resilience;
- that some such relationships and investments are enhanced by GSMA providing short-term seed funding for businesses that want to evidence and scale the potential impacts of technical solutions they have already developed on governments, communities and marginalised groups;
- that GSMA is able to support capacity-strengthening needs of diverse actors involved in developing solutions as well as end users.

Although this seems like a linear trajectory in theory, there are various causal pathways from raising awareness to scaling, and some do not involve direct funding by GSMA. We are planning to undertake more in-depth analysis of these assumptions later in the evaluation process.

B. Parts of the GSMA M4D climate portfolio are evaluable in practice: Ongoing mapping of GSMA initiatives undertaken since 2019/2020 within what is now called the climate portfolio suggests that work in some sectors and aspects of the ToC is more evaluable than others. Evaluability in practice is influenced by:

- **Challenges identifying some relevant initiatives:** Recent initiatives led by the GSMA Climate Tech team, such as the GSMA M4D Innovation Fund rounds 3, 4, 5 and 6 have clear climate action objectives. However, as the climate innovation ecosystem is in such a nascent stage, most applications have tended to focus on established models for agri advisory in what some respondents termed relatively 'climate-safe settings'.¹⁴⁶ GSMA's insight analysis and learning reveals that applicants struggled to articulate value propositions that outlined climate outcomes and impacts.

Similar challenges arise when trying to categorise climate action interventions led by GSMA's Digital Utilities and Inclusion teams or the M4H programme funded under the FCDO sponsored SP2 and M4H as well as work funded by other donors. Though much of the Digital Utilities portfolio has contributed (and continues to contribute) to climate change mitigation, adaptation and resilience, such climate action aims were not the primary motivations of the work.

Similarly, much work under M4H has traditionally contributed to absorptive (cash voucher assistance) and anticipatory capacities (early warning systems) of people affected by crises and disasters made worse by climate change [Mobile for Humanitarian Innovation Portfolio \(gsma.com\)](https://gsma.com). However, until recently, they were developed under disaster response and preparedness frameworks. Thus, links to climate action have only recently been made explicit. While on the one hand this has made identifying potentially relevant initiatives more challenging, on the other it justifies the aims of the formative evaluation, which are to map them, and capture insights to make the GSMA M4D climate tech use case more robust.

- **Wide range of locations, themes, sectors and types of technology use cases within the portfolio:** One of the implications of seeking to raise awareness about the multiple possible roles of technology (including frontier technology) with big flagship reports while also running very open Innovation Fund calls is that GSMA's climate portfolio is very diverse and fragmented. Earlier rounds of the M4H Innovation Fund are enabling some meaningful insights work on early warning systems, and ongoing research involving FCDO is focusing on innovations in agriculture. If these studies are complete in coming months, they can feature in the evaluation and may provide opportunities to say something robust about specific uses of technology for specific problems arising from climate change such as the use of climate information.

However, we are unlikely to be able to undertake any robust novel synthesis around any other themes such as climate finance, sectors such as natural resource management, or technologies like blockchain and AI that are currently being trialled by GSMA M4D in the climate space. Our focus will instead be on whether GSMA's current theories of action work to deliver on its theory of change. We will do this by not only exploring whether GSMA is doing things right in terms of achieving outputs and immediate outcomes, but also whether it is doing the right things to achieve desired impacts at scale. **We will test whether GSMA M4D's approach to generating and using evidence on climate tech innovation to raise awareness, broker relationships and inspire collaborative climate action among public, private actors and the mobile industry is creating a more enabling environment**

¹⁴⁶ FCDO 2024 Annual Review Report [D0005093.odt \(live.com\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/123456/D0005093.odt)

that can be leveraged to achieve greater climate and environmental resilience of large numbers of vulnerable people in low- and middle-income countries (LMICs).

- ***Initiatives being of varying stages of maturity.*** A considerable body of Digital Utilities' work using mobile technology and the Internet of Things (IoT) in areas of water, energy, waste management that implicitly contributes to climate action areas of mitigation and adaptation is relatively mature.¹⁴⁷ The same can be said for M4H's work on anticipatory and absorptive actions¹⁴⁸ such as early warning systems, cash voucher assistance and climate information for agricultural adaptation and resilience. Some of the much more explicit work led by the Climate Tech team using frontier technologies (which also encompasses biodiversity and sustainable environment resource management) is more nascent. The evaluation terms of reference anticipates the implications of these varying levels of maturity partly through the inclusion of a literature review. Thus, they should not undermine our ability to assess whether key elements of the GSMA M4D Climate Tech innovation model and approach to inspiring collaboration on climate action are likely to work or not. However, this again limits what we will be able to say on the effectiveness of GSMA's contribution to climate action using particular technologies, especially in new sectors and themes. Currently, we anticipate we may be able to evaluate the potential effectiveness of some technologies (e.g. mobile used for weather information and early warning systems). Smart meters are another possibility.
- ***Availability of secondary monitoring data is uneven:*** Unsurprisingly, given the complex nature of the climate portfolio described above, it appears to be easier to locate monitoring, evaluation and learning data for some areas of the M4D Climate ToA/ToC than others. Thus far, we have identified some excellent evaluation reports and insight work that will play an extremely useful role in the evaluation.¹⁴⁹ However, we note that context and monitoring data for some more recent work on advocacy and partnerships, particularly at country level, as well as the longer-term impacts of innovation grants, is harder to locate. So far, we have only been able to locate endline data and scalability data for Round 4 of the Innovation Fund though we understand reports for more recent grants may be forthcoming. Overall, however, deeply contextualised evidence of sustained impacts of innovation grants at community and household levels is likely to be sparse. This means that we are not able to include context analysis in the inception report as is usual, and will instead be undertaking such analysis during the evaluation. Moreover, without additional primary research at this level or access to findings from GSMA's ongoing research, we may have to rely on evidence from the literature review to draw conclusions on potential impacts of innovation grants.

The evaluation should be useful and practical: The enthusiasm of staff interviewed and their willingness to connect the evaluators with stakeholders (for example, at the upcoming boot camps and MWC conference in Kigali, Rwanda) suggests the evaluation is seen as useful and practical. Outside of the Climate Tech team, explicit work on climate action has not been a priority to date, even

¹⁴⁷ KII with GSMA staff.

¹⁴⁸ [The GSMA Innovation Fund for Anticipatory Humanitarian Action | Mobile for Development](#)

¹⁴⁹ For example baseline, endline, scalability and environmental assessments for the first round of the Climate Tech Innovation Fund, an external learning paper to explore if and how its advocacy activities have contributed to a more enabling environment for digital inclusion, climate resilience, innovation, and scaling businesses; an evaluation of partnerships, outcome harvest data from Digital Utilities Work; and endline report by the Research People (TRP) to track GSMA's contribution to change and generate learning from M4H 2017-2022 [M4D M&E - M4H MEL Partner Endline Report - Final version.pdf - All Documents \(sharepoint.com\)](#); and a learning document on Partnerships for Scale [M4D M&E - Private Sector Partnerships for Scale- Learning Document- Final.pdf - All Documents \(sharepoint.com\)](#)

though most acknowledge that their ongoing work contributes to climate action in one way or another. There is therefore great interest by some programme staff in developing stronger climate narratives, learning agenda and use cases within M4D that contextualise the role of GSMA in this space compared with other actors. As mentioned above, this will involve exploring the implicit value proposition that GSMA is best qualified and placed to support, test, research and support advocacy and learning that increases the use of digital technologies for climate action at scale. MEL staff are keen to gain greater insights into the effectiveness and impact of GSMA M4D's work in the climate space, and this is likely to be challenging for reasons outlined above.

Annexe 4: GSMA M4D Climate and Digital Review scoping note

Objective

- Address the evaluation question:
 - According to the wider evidence base, how and why, for whom, and under what conditions (including barriers and how to address these) do digital and mobile technologies contribute to climate mitigation, adaptation/resilience and sustainable resource/environmental management?
- Provide evidence-based insights to assess and propose updates to the M4D Climate Action and Climate Tech theories of change, as well as programme and country strategies and approaches (Theories of Action)

Scope (15 pages max, not including work cited and any annexes)

- State of evidence on meaningful, sustainable and equitable climate mitigation, adaptation and resilience, include what it takes to achieve these in LMICs (20-25 citations)
- State of evidence on the role of digital and mobile technologies in contributing to achieving climate mitigation, adaptation and resilience in LMICs (GSMA resources + 15-20 citations)
- Evidence-based assessment of and recommendations for M4D climate action and climate tech ToCs (potentially including a suggested updated ToC)

Approach

- **Climate Mitigation, Adaptation and Resilience.** The literature review will start by identifying and drawing on broader frameworks related to climate action to clarify relevant concepts and definitions. Then the review will identify and assess any existing systematic/literature reviews covering these domains, and finally identify and assess more recent and relevant evidence.
 - Evidence and frameworks for defining effective, impactful, sustainable and inclusive climate mitigation, adaptation and resilience in LMICs
 - Climate Change Mitigation
 - Climate Change Adaptation and Resilience
 - Sustainable Natural Resource and Environmental Management and Governance
 - Just Transition
 - Transformational Change
 - Evidence and insights from research and practice on what it takes to achieve meaningful, sustainable and equitable climate mitigation, adaptation and resilience in LMICs
 - Identify and assess any existing systematic or literature reviews
 - Identify and assess most relevant and recent evidence
- **Role of Digital / Mobile Technology in Climate Mitigation, Adaptation and Resilience.** The second stage of the literature review will be to focus on digital and mobile technologies. First, any broad systematic/literature reviews of the roles of relevant technologies for broader social or sustainable development will be identified and assessed, followed by any more specific evidence related to digital and mobile tech for climate action. To further complement these broader areas, evidence relating to specific uses of digital/mobile technology (starting from the conceptual framework from [The Role of Digital and Mobile-Enabled Solutions in Addressing Climate Change](#), p. 13), and potentially a small number of specific areas of climate tech, will be identified and assessed.
 - Broader evidence on ICT for Social/Sustainable Development
 - Identify and assess any existing systematic or literature reviews
 - BIF Literature Review

- Digital/Mobile Tech for Climate
 - Identify and assess any existing systematic or literature reviews
 - GSMA 2021 Scoping Paper and other relevant research
 - 3-4 deeper dives on evidence for specific areas of climate tech (from those outlined in the 2021 scoping report; to be mutually agreed on between TAP Room and GSMA)
 - Early warning and anticipatory action(M4H)
 - Sustainable utilities and renewable energy (GSMA to share more specific areas of focus)
 - Natural resource management and environmental sustainability
 - Community Based Adaptation

- Based on the evidence for climate action and roles and contributions of digital and mobile technology, the review will develop key insights about what it takes for digital/mobile technology to contribute to meaningful, sustainable and inclusive climate mitigation, adaptation and resilience
 - Barriers and enabling conditions
 - Roles of technology for different actors/users (see preliminary matrix below)
 - Causal pathways for meaningful contribution
 - Effective approaches for leveraging technology

- Finally, the evidence based insights will be applied to the existing Theories of Change for GSMA climate efforts, suggesting potential areas for updating and refining these.
 - Assessment of M4D and Climate Tech ToCs based on evidence and insights
 - Recommendations for updating/refining M4D and Climate Tech ToCs
 - Recommendations for country/programme specific approaches/strategies (ToAs)

Table 1: Potential Roles / Uses and Actors / Users for Climate Tech

To be updated / iterated as needed

Roles / Uses of Climate Tech	Individuals	Collectives (Communities, Associations etc.)	Private Sector	Government
Connecting to other actors				
Information provision				
Resources				
Services				
Data generation				
Other (e.g., frontier tech)				

Annexe 5: Evidence gap map process and protocol

To construct the evidence gap map (EGM), a systematic review was conducted following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The process included the following steps:

Step 1. Eligibility criteria

The inclusion criteria for this systematic review were: (a) peer-reviewed journal articles; (b) studies published in English after 2015; (c) empirical research employing qualitative, quantitative, or mixed-methods approach; and (d) studies explicitly addressing mobile digital technology, climate resilience, mitigation, and adaptation, and sustainable resource/environmental management. Exclusion criteria included grey literature, theoretical papers, opinion articles, and studies lacking primary data. The cut-off year 2015 was selected, as it marks the adoption of the United Nations' Sustainable Development Goals (SDGs) and the Paris Agreement, which significantly influenced global climate change research.

Step 2. Information sources and search strategy

A comprehensive literature search was conducted in Scopus, selected for its extensive coverage of high-quality, peer-reviewed literature across disciplines in science, technology, social sciences, and humanities, providing a robust multidisciplinary dataset. Additionally, TAP Room used Scopus for their EGM study. The search was last updated on November 13, 2024. The search terms, developed using the Boolean operators and free-text keywords, followed this logic: *[mobile digital] AND [climate OR environment]*. The primary search strategy included the following terms:

- **Mobile digital technology terms:** "Mobile Phone" OR "Mobile *communication" OR "Mobile connect*" OR "Mobile Device" OR "Mobile Computing" OR "Mobile App*" OR "Mobile Platform" OR "Mobile Network" OR "Mobile Internet" OR "Mobile Data" OR "Mobile Money" OR "Mobile Payment" OR "Smartphone" OR "Smart Device" OR "Portable Device" OR "whatsapp" **AND**
- **Climate-related terms:** ("Climate change" OR "Climate * Mitigation" OR "Climate * Adaptation" OR "Climate * Risk" OR "Climate * Service" OR "Climate * Smart" OR "Climate Finance" OR "adaptive management" OR "risk assessment" OR "risk mitigation" OR "smart farming" OR "smart agriculture" OR "water management" OR "land management" OR "environmental management" OR "disaster management" OR "early warning system" OR "disaster response" OR "forestry" OR "carbon footprint" OR "carbon emission" OR "Greenhouse Gases" OR "biodiversity" OR "environmental conservation" OR "sustainable develop*" OR "Nature-based")

This initial search yielded a total of 566 articles for screening.

Step 3. Study selection (title and abstract screening)

Rayyan, a collaborative platform, was used for screening. To ensure reliability, each article was independently assessed by at least two of the three EGM team members. Only articles that meet the following two inclusion criteria were selected: (a) explicitly mention mobile digital technology; and (b) explicitly mention climate adaptation, resilience or risk management. Articles mentioning mobile digital technology only in recommendations or focusing on technology development (e.g. telecommunications, cybersecurity, 5G networks, algorithm modelling) were excluded. Articles focusing on climate-related topics (e.g. tree imaging, riverbank filtration systems, carbon trading) without explicit relevance to mobile digital technology were excluded. Discrepancies were resolved through discussion. 132 articles were selected for full-text screening.

Step 4. Additional study identification (snowballing and 3ie EGM review)

To ensure thoroughness, two complementary approaches were used: snowballing methods and reviewing 3ie EGMs. **Snowballing techniques** were used to identify relevant studies that may not have appeared in the initial database search. This process included: (a) manual reference screening of review articles identified in Step 3, ensuring the inclusion of foundational and influential works in the field; (b) citation network analysis using *ResearchRabbit*, an AI-powered tool, to track citation patterns and identify key studies connected to those already included. This helped uncover research that aligned with the study's thematic focus but might not have been directly captured by the keyword search; (c) Google Scholar's 'Related Articles' function, which allowed for the expansion of citation networks and helped capture studies from journals that may not be indexed in Scopus. For each method, one team member screened the first two pages of search results, selecting titles that aligned with the study scope. Abstracts of these articles were then assessed using the same inclusion criteria as in Steps 1 and 3. Through this approach, nine additional studies were identified for full-text screening.

To further broaden the evidence base, we systematically **reviewed two 3ie EGM reports** that provided structured assessments of research evidence on climate resilience and adaptation: [Building resilient societies in low- and middle- income countries](#) and [Land-use change and forestry programmes in low- and middle-income countries](#). Both reports were screened following the inclusion criteria outlined in Steps 1 and 3. From these reports, 18 additional studies were identified for full-text screening. The final list of articles obtained through keyword search and snowballing was cross-validated to eliminate duplicates and ensure relevance and coherence with the study's focus.

Step 5. Data extraction and synthesis

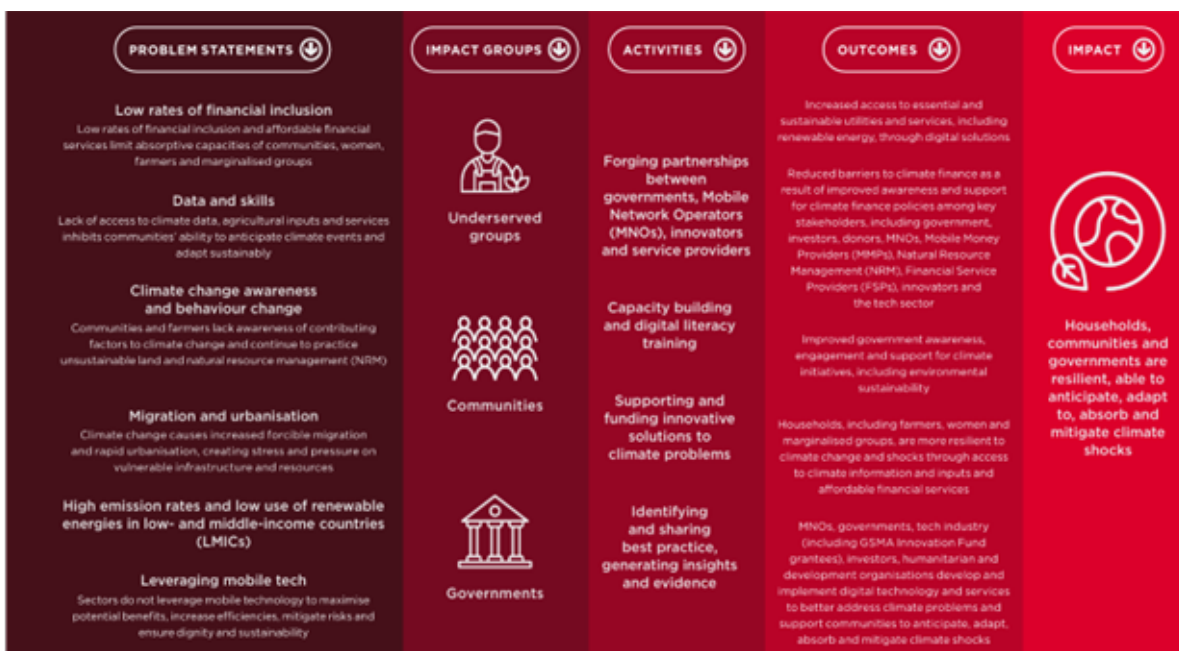
A total of 146 articles were extracted for full-text analysis and coding using EPPI-Reviewer, a web-based software for analysing systematic reviews that facilitates collaborative and transparent analysis. Full-text analysis resulted in the exclusion of 2 studies, **leaving a final total of 144 studies in the EGM**. The extracted data included four categories agreed in advance with GSMA outlined in the framework below. The extracted data were used to create an EGM visualisation using Eppi-Mapper.

Annexe 6: GSMA formative evaluation – Kenya case study

1. Introduction

This case study summarises findings from research on initiatives implemented by GSMA’s Mobile for Development (M4D) and Mobile for Humanitarian Innovation (M4H) programmes in Kenya, which form part of a portfolio later framed within a Climate Impact Narrative (see Figure 1). As the activities were not guided by an overarching country-level climate strategy, and the evaluation team lacked information on GSMA’s plans for climate action in Kenya, it is not a strategy review; we offer no country-specific recommendations in terms of a thematic or technology focus. Rather, strategic recommendations relate to ways of working to enhance impact.

Figure 1: GSMA’s Climate Impact Narrative



Source: GSMA Mobile for Development Climate Impact Narrative, GSMA 2023.

The methodology used to conduct this case study is described in the main evaluation report. It speaks mainly to evaluation question (EQ)2 in the overall evaluation design: *Testing the GSMA M4D climate tech 'use case' or theory of action: how, why and to what extent is GSMA's M4D climate approach likely to have anticipated impacts in areas of climate change mitigation, adaptation, resilience, natural resource management (NRM) and environmental sustainability for target populations?*

We begin by outlining the context for GSMA’s climate actions in Kenya, assessing how well its problem analysis aligns with relevant policy frameworks, and the broader enabling environment for climate tech (Section 2). Section 3 examines the relevance of GSMA M4D’s climate initiatives to government priorities and assesses their internal coherence. Section 4 maps evidence of progress across the outcome areas defined in the Climate Impact Narrative, while Section 5 explores how, why and to what extent GSMA’s innovation model is functioning effectively. Section 6 summarises key strengths and areas for improvement to enhance GSMA’s impact on climate change mitigation, adaptation, resilience, NRM and environmental sustainability for target populations. We present some general recommendations here, but there is more detailed guidance presented under EQ3 in the main evaluation report and other relevant annexes.

2. Context

Kenya makes a small contribution to the total global greenhouse gas (GHG) emissions but is acutely vulnerable to climate change. Ranked 42nd among the world's most climate-vulnerable countries,¹⁵⁰ it is increasingly affected by floods, droughts, landslides and temperature variability.¹⁵¹ These hazards disrupt livelihoods in key sectors, including agriculture, water, energy and transport.¹⁵² Recurrent droughts affect food production and hydropower, and floods destroy infrastructure.¹⁵³ Erratic weather patterns jeopardise national development goals and increase economic risks, particularly in climate-sensitive sectors.¹⁵⁴

Despite these vulnerabilities, Kenya leads in renewable energy adoption, with 90% of its electricity sourced from renewables, notably geothermal and hydro.¹⁵⁵ However, resource constraints, political instability and limited adaptation financing have hindered the climate response.¹⁵⁶

Vulnerability to climate-related hazards in Kenya varies, and is shaped by socioeconomic, geographic and institutional factors that lead to the challenges outlined in GSMA's problem analysis. Exposure to climate risks varies across regions due to differences in topography and meteorological conditions.¹⁵⁷ Vulnerability among population groups is further shaped by structural inequalities, gender norms, wealth and income disparities, age, and unequal access to institutions and services.¹⁵⁸ These factors, recognised in policy analysis and National Adaptation Plans, align with GSMA M4D's analysis of barriers to the use of technology in enabling effective climate tech solutions (Table 1).

Table 1: Barriers to climate action caused by structural causes of climate vulnerability

GSMA analysis of barriers to tech use	Contextualised examples in Kenya
<i>Low financial inclusion and affordable financial services</i>	Only 2.4% of the population have access to credit from formal financial sources; 53% of the adult population are financially excluded. ¹⁵⁹
<i>Lack of access to relevant climate data skills and resources</i>	Although Kenya does relatively better than other African countries in terms of investments in climate forecasting, the accessibility of climate data for agriculture is still a challenge. ¹⁶⁰

¹⁵⁰ <https://gain.nd.edu/our-work/country-index/rankings/>

¹⁵¹ KMD. (2023) 'State of the Climate Kenya 2023'. Kenya Meteorological Department. https://meteo.go.ke/sites/default/files/downloads/SoC%20Kenya%202023_1.pdf

¹⁵² World Bank Group. (2023) Kenya Country Climate and Development Report. Washington DC: World Bank. <http://hdl.handle.net/10986/40572>.

¹⁵³ KMD. (2023) 'State of the Climate Kenya 2023'. Kenya Meteorological Department.

¹⁵⁴ World Bank Group. (2023) Kenya Country Climate and Development Report. Washington DC: World Bank. <http://hdl.handle.net/10986/40572>:

¹⁵⁵ <https://www.iea.org/countries/kenya/electricity>

¹⁵⁶ Biegon et al. (2024) *Budget adaptation? What we know about how Kenya's budget is evolving to tackle climate adaptation*. Bajeti Hub and Institute of Public Finance.

¹⁵⁷ Government of Kenya (2023) National Climate Change Action Plan (Kenya) 2023-2027. Ministry of Environment, Climate Change and Forestry, Nairobi, Kenya.

¹⁵⁸ Government of Kenya (2023) National Climate Change Action Plan (Kenya) 2023-2027. Ministry of Environment, Climate Change and Forestry, Nairobi, Kenya.

¹⁵⁹ [Financial Inclusion in SSA](#)

¹⁶⁰ [As Africa opens a climate summit, poor weather forecasting keeps the continent underprepared | AP News](#)

<i>Low climate awareness of causes of climate change at community level</i>	In 2023, only 50% of Kenyans were aware of climate change. ¹⁶¹
<i>Climate change contributes to migration and urbanisation</i>	Climate change is an established driver of migration to cities and there is a need for policies that enable urban poor people to better adapt. ¹⁶²
<i>High emission rates and low use of renewables</i>	Despite a large proportion of electricity being generated from renewables, 600 million Kenyans are not on the grid. As of 2024, Kenya's adoption of renewable energy by the general population was slower than planned. ¹⁶³
<i>Sectors do not leverage mobile tech to address climate change problems</i>	There has been considerable piloting of tech in agriculture, but challenges include lack of access to smartphones and little work on environmentally sustainable practices. ¹⁶⁴ There has been some experimentation with the Internet of Things (IoT) for digital utilities such as water and waste management. ¹⁶⁵

GSMA's Climate Tech initiatives operate within a rapidly evolving and complex environment in Kenya. The policy environment is generally favourable but there are challenges:

- **Government commitment to climate action and digitalisation is not well coordinated:** Climate change and digitalisation are both government priorities, but they are often addressed separately in policies. The National ICT Policy highlights ICT as a tool for climate adaptation, monitoring and mitigation, and promotes its use for disaster management.¹⁶⁶ It also acknowledges the environmental impact of the telecom sector, aiming to reduce e-waste and increase efficiency in ICT equipment. While such integration is encouraging, it is not yet consistent or fully implemented across all sectors.¹⁶⁷
- **Gaps in disaster risk and climate resilience planning:** Kenya's commitment to the Sendai Framework for Disaster Risk Reduction (2015) reinforces the importance of digital tools in disaster management and public engagement.¹⁶⁸ Yet the Government Enterprise Architecture Framework offers limited guidance on DRR or climate resilience.¹⁶⁹ Kenya's Nationally Determined Contributions (NDCs) also lack explicit reference to digital technologies, though both the National Adaptation Plan and the National Climate Change Action Plan do highlight them as key enablers.¹⁷⁰

¹⁶¹ [AD696: Kenyans want more government action to fight climate change, and stand ready to help – Afrobarometer](#)

¹⁶² National Climate Adaptation Plan, page 5, International Organization for Migration (IOM) (2023) [Analysis of Human Mobility in the National and County Climate Change and Disaster Risk Reduction Frameworks in Kenya, Kenya National Adaptation Plan 2015-2030 | United Nations Network on Migration](#)

¹⁶³ [Renewable energy status and uptake in Kenya - ScienceDirect](#)

¹⁶⁴ [Kenya's farmers have lots of digital tools to help boost productivity – how they can be made more effective](#)

¹⁶⁵ [The State of IoT in Kenya. | by Awi Ellie | Medium | Medium](#)

¹⁶⁶ Ministry of Information, Communications and Technology, Kenya. (2019) National Information, Communications and Technology (ICT) Policy, p 27. <https://www.ict.go.ke/wpcontent/uploads/2019/12/NATIONAL-ICT-POLICY-2019.pdf>

¹⁶⁷ Kenya - Country Climate and Development Report : Digital Sector Background Note (English). Washington DC: World Bank Group. <http://documents.worldbank.org/curated/en/099111523061542518>

¹⁶⁸ <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>.

¹⁶⁹ The Government Enterprise Architecture Framework (<https://www.icta.go.ke/ict-standards>)

¹⁷⁰ Government of Kenya (2023) National Climate Change Action Plan (Kenya) 2023-2027. Ministry of Environment, Climate Change and Forestry, Nairobi, Kenya.

- **Kenyan mobile network operators are well-positioned to play roles.** There are four main MNOs: Safaricom, Airtel Kenya, Telkom Kenya and Finserve. Safaricom dominates with a 65% market share, and its mobile money platform, M-PESA, forms a core pillar of the digital economy.¹⁷¹ Key MNOs have established environmental and social responsibility (ESR) agendas, though the extent to which these are strategically aligned with national climate goals varies.¹⁷²
- **Political economy shapes the innovation ecosystem:** Safaricom’s success (for instance) is situated within a political context often described as ‘developmental patrimonialism’, where elite interests are protected and political power is reinforced through control over profitable ventures. This environment enables innovation but also brings challenges for coordination.¹⁷³ It also centralises profits and influence, shaping how MNOs and other actors operate within the digital and climate space.¹⁷⁴
- **Poor connectivity despite a mature information and communication technology (ICT) sector:** Kenya’s mature ICT sector accounts for 15% of the country’s exports,¹⁷⁵ and provides significant capacity for leveraging digital technologies in climate action. However, GSMA’s Mobile Connectivity Index score of 50.6 highlights significant connectivity challenges that persist, particularly in relation to affordability.¹⁷⁶
- **Kenya’s tech-friendly climate action ecosystem:** There are a wide range of funders, investors, tech companies and civil society actors funding and implementing programmes on adaptation and mitigation, many of whom are interested in technology.

3. Relevance and coherence of GSMA M4D’s climate actions (EQ2.1 and EQ2.4)

GSMA M4D’s activities are relevant to Kenya’s climate policy priorities. Supported by colleagues in London, a large team of 17 Kenyan staff from GSMA M4D’s Climate Tech, Innovation Fund, Digital Utilities, Central Insights Unit (CIU), Agritech, Connected Women, Mobile Money, and monitoring and evaluation (M&E) teams have been involved in at least 13¹⁷⁷ initiatives to address key challenges identified in the Climate Impact Narrative.¹⁷⁸ These are directly relevant to the Kenyan policy context, seeking to address issues that exacerbate vulnerabilities to hazards in line with government adaptation priorities. These cover all activity types in GSMA M4D’s innovation model and respond to the enabling environment.

Table 2: Mapping GSMA M4D’s Climate Actions against policy priorities

Government policy priorities	GSMA M4D Climate Action initiatives
Disaster risk management, including improving dissemination of emergency	National Drought Management Authority (NDMA): M4H signed a partnership with Kenya’s NDMA at the Mobile World Capital (MWC) event in Barcelona 2024 to support

¹⁷¹ <https://www.statista.com/statistics/1064148/mobile-market-share-kenya/>

¹⁷² KII MNO

¹⁷³ Omala, M.A., Kioko, E. and Gravesen, M. (2024) Effective climate finance coordination? Stakeholder perceptions, climate change policy implementation and the underlying political economy factors in Kenya. *Climate Policy* 24(7): 863–877.

¹⁷⁴ Tyce, M. (2020) Beyond the neoliberal-statist divide on the drivers of innovation: a political settlements reading of Kenya’s M-Pesa success story. *World Development* 125: 104621. <https://doi.org/10.1016/j.worlddev.2019.104621>.

¹⁷⁵ World Bank Group. (2023) Kenya Country Climate and Development Report. Washington DC: World Bank. <http://hdl.handle.net/10986/40572>

¹⁷⁶ <https://www.mobileconnectivityindex.com/index.html#year=2023&zonesoccode=KEN&analysisView=KEN>

¹⁷⁷ The Evaluation team were able to identify 13 climate initiatives in/related to Kenya in our mapping of the GSMA Climate portfolio. However, due to the fragmented nature of the climate portfolio across multiple teams there may have been some which were not included.

¹⁷⁸ Interviews with various GSMA M4D staff

<p>response resources.¹⁷⁹ and farmers' ability to cope with drought through access to climate information</p>	<p>government involvement in a digital ecosystem that enables absorptive capacity through humanitarian cash assistance.¹⁸⁰</p> <p>World Vision Kenya (WVK) has used strategic partnerships and innovative methods to support climate adaptation and restore livelihoods where land is severely degraded.¹⁸¹ GSMA supported other tech partners connect with MNOs in the Tana River Climate Change and Livelihoods Restoration Project (T-CLIRP). The project provides short-term emergency response to enhance absorptive capacity while also supporting participatory community-led sustainable NRM and farmland restoration for longer-term community-wide adaptive capacity.</p> <p>Synneffa offers solutions to help farmers enhance anticipatory and adaptive capacity in the face of unpredictable weather patterns. An Unstructured Supplementary Service Data (USSD)-based interface aims to increase accessibility to climate information generated by satellite imagery, and IoT will help farmers plan and increase productivity and yields.¹⁸²</p>
<p>Nutrition and food security, including through climate-smart agriculture and fisheries.¹⁸³</p>	<p>Aquarech aims to improve the productivity of fish farmers, with IoT sensors and advice via a mobile app. The solution establishes the right water temperature for feeding. Farmers can also buy fish food and sell produce through the Aquarech platform. As more farmers turn to fish farming, this could contribute to anticipatory, absorptive <i>and</i> adaptive capacity.¹⁸⁴</p> <p>Ujuzi Kilimo promotes climate-smart precision agriculture for smallholder farmers by making soil testing services more accessible. Their SoilPal sensor device will generate information that will be sent by SMS. It aims to help farmers make data-driven decisions to enhance productivity, incomes and food security, while promoting sustainable practices (absorptive and adaptive capacity).¹⁸⁵</p> <p>Farm to Feed addresses food loss by creating a market for imperfect or surplus produce. It connects smallholder farmers with buyers to increase income, absorptive and possibly adaptive capacity, reducing food waste. The GSMA-funded project aims to increase scale while expanding the e-commerce platform to attract more B2B buyers.¹⁸⁶</p>
<p>Forestry wildlife and tourism, preventing deforestation, and reforestation for mitigation and resilience,</p>	<p>Safaricom and 4R Digital partnership: Following GSMA insights work on community forestry,¹⁸⁸ Safaricom and 4R Digital are building on the former's long-term ESR reforestation programme to offset its carbon emissions. This</p>

¹⁷⁹ [napgn-en-2022-kenya-NCCAP-2018-2022-Implementantion-Status-Report.pdf](#), pages 10–11

¹⁸⁰ M4H 2024 Annual Report

¹⁸¹ [Climate change adaptation and livelihood restoration in Tana River Delta: Embracing innovative approaches and technology](#)

¹⁸² [Synneffa | Mobile for Development](#)

¹⁸³ [napgn-en-2022-kenya-NCCAP-2018-2022-Implementantion-Status-Report.pdf](#), page 12

¹⁸⁴ Aquarech CRA Fund Final Reporting, KII partner

¹⁸⁵ [Ujuzi Kilimo | Mobile for Development](#)

¹⁸⁶ [Farm To Feed | Mobile for Development](#)

¹⁸⁸ [Mobile Technology for Participatory Forest Management: Co-designing and testing prototypes in Kenya | Mobile for Development](#)

<p>including through the use of technology and sensors¹⁸⁷</p>	<p>is implemented in partnership with the Kenyan Forestry Service and Community Forestry Associations. The work aims to track reforestation using remote sensing, and support Safaricom to leverage its nascent Carbon Value Exchange (CaVEx) platform, to simplify accessing carbon markets and generating revenue for forestry groups.</p> <p>United Nations Development Programme (UNDP): GSMA plans to collaborate with UNDP to produce a Kenya-focused policy brief on how to leverage digital technology for biodiversity.¹⁸⁹</p>
<p>Health, sanitation and human settlements, including promoting recycling to divert collected waste away from disposal sites¹⁹⁰</p>	<p>Taka ni Mali began as a corporate social responsibility (CSR) project aimed at organising the waste value chain. The initiative enhances waste disposal by using IoT-enabled smart bins and a digital platform to optimise collection routes, reduce fuel use and cut emissions. Real-time data improves planning and supports recycling efforts. The bins also educate users on recycling practices, promoting a more efficient and circular waste system.¹⁹¹</p> <p>Kenya Alliance of Resident Associations (KARA): In 2024, GSMA Digital Utilities collaborated with KARA to organise a forum to promote digital solutions in waste management in Kenya. There were more than 40 participants from waste management, start-ups, municipal decision-makers, mobile operators, and resident association representatives across the country.¹⁹²</p>
<p>Water and the blue economy, promoting water efficiency in the face of declining water resources due to climate change (monitor, reduce, reuse, recycle and model)¹⁹³</p>	<p>Wonderkid provides a platform to improve digital payments, billing, revenue collection, operations and customer service for Kenyan water utilities, increasing energy efficiency and reducing water waste. It has innovated and expanded to other countries, to make the platform and services more accessible to smaller companies too.¹⁹⁴</p>
<p>Inclusion: National Adaptation Plans recognise additional vulnerability of women, girls and other groups¹⁹⁵</p>	<p>Several grantees (e.g. Ujuzi Kilimo, Syneffa) deployed USSD, interactive voice response (IVR) or offline training to reach digitally excluded groups.¹⁹⁶</p>

There is coherence in the themes GSMA is working on, but a lack of organisational coherence in ways of working undermines efficacy. Despite promising results in bringing

¹⁸⁷ [napgn-en-2022-kenya-NCCAP-2018-2022-Implementantion-Status-Report.pdf](#), page 49

¹⁸⁹ Interview GSMA staff

¹⁹⁰ [napgn-en-2022-kenya-NCCAP-2018-2022-Implementantion-Status-Report.pdf](#), page 23

¹⁹¹ [Catalysing Partnerships in Plastics - Exploring the Potential for Collaboration between Mobile Network Operators and Plastics Organisations](#)

¹⁹² Interviews and discussions GSMA staff, [Highlights from the GSMA Digital Urban Utilities Forum on Waste Management in Nairobi | Mobile for Development](#)

¹⁹³ <https://napglobalnetwork.org/wp-content/uploads/2022/01/napgn-en-2022-kenya-NCCAP-2018-2022-Implementantion-Status-Report.pdf>, page 15

¹⁹⁴ [Highlights from the GSMA Digital Urban Utilities Forum on Waste Management in Nairobi | Mobile for Development](#)

¹⁹⁵ <https://napglobalnetwork.org/wp-content/uploads/2022/01/napgn-en-2022-kenya-NCCAP-2018-2022-Implementantion-Status-Report.pdf>

¹⁹⁶ KILs with partners

together local/national actors on circular economy and waste management, there is weak internal coherence:

- *Fragmentation*: Activities across GSMA M4D and M4H are fragmented. Grantees working on similar issues do not seem connected, and GSMA teams reportedly ‘trip over’ each other on occasion due to separate relationships with the same stakeholders.¹⁹⁷
- *Strategic coordination*: There is a lack of strategic coordination across different teams working with partners in the same country, undermining the effective learning and collaboration necessary to achieve impact at scale.¹⁹⁸

4. Contributions to expected outcomes (EQ2.3 and EQ2.4)

GSMA initiatives are fostering connections among stakeholders to adopt climate tech. Promising outcomes are emerging in building anticipatory and absorptive capacities at household and community levels. Impacts on adaptive capacity and extreme vulnerability experienced by very poor citizens appear more limited.¹⁹⁹

Table 3: Mapping progress on outcomes against the Climate Impact Narrative

GSMA outcome area	Progress to date
MNOs, governments, tech industry (including GSMA Innovation Fund grantees), investors, humanitarian and development organisations develop and implement digital technology and services to better address climate problems and support communities to anticipate, adapt, absorb and mitigate climate shock	<p>GSMA M4D’s financial, technical and relational support has enabled various actors to experiment and or learn about new potential mobile use cases for climate action and their roles within them. Some have developed new relationships and others attract additional investment to scale efforts – for example:</p> <ul style="list-style-type: none"> • MNOs: GSMA has supported relationships between Safaricom and 4R Digital (carbon credits), Taka ni Mali, KARA, as well as start-up grantees. • Government: see below. • Tech industry: Aquarech, Ujuzi Kilimo, Syneffa and Farm to Feed are engaging with MNOs and investors at bootcamps. Other examples include Ushahidi. • Investors/funders: UNDP is engaging GSMA on the potential of tech for biodiversity initiatives. GSMA supported Aquarech in leveraging investment from Aqua-Spark, a Netherlands-based global aquaculture investment fund. Aquarech raised US\$1.9 million during the grant. • Humanitarian and development organisations: World Vision Kenya and its partners (such as Ushahidi) have benefited from access to GSMA’s links to Safaricom. GSMA introduced Taka ni Mali to the UN Global Compact and the International Solid Waste Association; GSMA supported Wonderkid to connect with the International Water Association and regional forums. This visibility, plus being featured in GSMA publications, has helped further connections such as with Imagine H2O, which led to them joining H2O’s Accelerator Programme.
Improved government awareness, engagement and support for climate initiatives,	Taka ni Mali and KARA : GSMA M4D does not engage directly with government in Kenya. However, its partnerships with Taka ni Mali and KARA were reported to be raising awareness among

¹⁹⁷ KII with 3 GSMA Staff

¹⁹⁸ Evaluator analysis based on efforts to map Kenya portfolio

¹⁹⁹ Please refer to the Outcome Analysis Annexe 9 for details on all outcomes in the table 3

<p>including environmental sustainability</p>	<p>government actors of the benefits of solid waste management and the circular economy.</p> <p>Kenya's NDMA agreed to support government involvement in a digital ecosystem that enables humanitarian cash assistance to be disbursed.</p> <p>T-CLIRP: GSMA M4D's support for the World Vision Kenya programme is assumed to have made a small, indirect contribution to government awareness on the potential of technology for NRM.</p>
<p>Reduced barriers to climate finance as a result of improved awareness and support for climate finance policies among key stakeholders</p>	<p>4R Digital is building on work and learning previously funded by GSMA M4D to support Safaricom to develop a CaVEx system that will enable the MNO to purchase credits from community forestry groups in collaboration with the Ministry of Forestry. This solution is anticipated to scale and provide a dominant platform for carbon credit training in the future. Possible impacts on incentives for different groups to engage in community forestry are yet to be tested.</p> <p>Other avenues into climate finance by GSMA partners (Taka ni Mali) and grantees (Aquarech, Syneffa, Ujuzi Kilimo) are more nascent. GSMA is helping them to explore options for accreditation to participate in carbon markets, and how this might be accommodated within their business models.</p>
<p>Increased access to essential and sustainable utilities and services, including renewable energy, through digital solutions</p>	<p>Taka ni Mali reports that GSMA's technical advice and support for its relationship with Safaricom has enabled improvements to waste management services because of smart bin technology. This helps to optimise waste collection routes, reducing unnecessary trips and ensure timely emptying of bins, leading to lower fuel consumption and reduced GHG emissions. Data analytics help municipalities and waste management companies make informed decisions about resource allocation and recycling programmes, enhancing overall efficiency.</p> <p>Wonderkid received support from GSMA to develop a successful platform to improve water management efficiency (2015–2018). Further support has enabled Wonderkid to develop regional relationships and scale. Despite its success in promoting efficient water management platforms, the evaluation team were not able to access evidence that this leads to more sustainable services to populations that are vulnerable to climate change.</p>
<p>Households, including farmers, women and marginalised groups, are more resilient to climate change and shocks through access to climate information and inputs and affordable financial services</p>	<p>Aquarech reports that new IoT water sensors, information and market services, supported by GSMA funding and technical assistance, have contributed to increased absorptive, anticipatory and adaptive capacities of fisherfolk, some of whom were women.²⁰⁰ However, the project had been delayed by ineffective sensors, and evidence of outcomes was fairly limited at the time of the evaluation.</p>

²⁰⁰ Aquarech endline report, KII partner

More sustainable NRM	4R Digital, Ujuzi Kilimo and Safaricom: There is no evidence for this, though the work (supported by 4R Digital and Safaricom) is expected to yield benefits for forestry management; and Ujuzi Kilimo’s advice (supported by the Innovation Fund) should also advance more environmentally sustainable farming practices.
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5. Conditions influencing outcomes and impacts (EQ2.4)

GSMA’s innovation model works well by leveraging incentives and building capacities that result in valued outputs. Partners in Kenya generally view GSMA’s insight reports, Innovation Fund grant-making, capacity-building and convening efforts as strong.²⁰¹ Despite limited progress to date in the areas of climate finance and NRM, it is still possible to conclude that GSMA M4D’s Innovation Fund, partnership support and capacity-building contribute to raising awareness and increased support for (or use of) digital tech for climate action. The role of insight reports in triggering climate action is more complicated. Some more high-profile reports – for example, on waste management (Taka ni Mali) and water (Wonderkid) – seem to play a role in convening and connecting.²⁰² The more embedded research approach within T-CLIRP illustrates how such an approach can be effective in generating and sharing insights and evidence.²⁰³

Our exploration of why GSMA M4D staff and colleagues have been successful in engaging actors in activities resulting in quality outputs and intermediate outcomes revealed the following causal mechanisms. These confirm implicit or explicit assumptions in the innovation model.

Table 4: How the GSMA M4D Climate Action innovation model has worked in Kenya

Area	Mechanism	Details
Catalytic funding and support to start-ups	Technical capacities	GSMA M4D builds capacity to develop innovative solutions, improve operational professionalism, and strengthen financial management that then has potential to contribute to climate outcomes (e.g. Ujuzi Kilimo, Syneffa). ²⁰⁴
	Relational capacities	GSMA M4D enhances start-up legitimacy by fostering relationships with MNOs, though these are not always successful (Aquarech). Relationships enabled start-ups to integrate mobile financial services, achieve customer base growth, and learn about how to access carbon credit markets (Aquarech, Syneffa, Ujuzi Kilimo). ²⁰⁵
Stakeholder convening and strategic collaboration	Commercial incentives	MNOs such as Safaricom are motivated to engage with GSMA and its partners because of their ESR goals, desire for brand enhancement, and customer growth/profit-making opportunities. ²⁰⁶
	Relational incentives	Multi-stakeholder approaches foster innovation, diverse collaboration, and strengthen networks across climate action ecosystems (e.g. on

²⁰¹ KIs and informal conversations with partners during bootcamp

²⁰² KIs 2 partners

²⁰³ [Climate change adaptation and livelihood restoration in Tana River Delta: Embracing innovative approaches and technology](#)

²⁰⁴ KIs Grantees

²⁰⁵ KIs grantees

²⁰⁶ KIs MNO and GSMA staff

Area	Mechanism	Details
		climate finance; water, sanitation and hygiene; and waste management). ²⁰⁷
	Policy incentives	Government actors and donors participate in events convened by GSMA partners (e.g. on waste management) to align with and advance their climate and technology policy agendas. ²⁰⁸
Identifying and sharing best practice	Reporting effect	Targeted, relevant insight reports can motivate participation in meetings and increase the confidence and visibility of start-ups featured (Wonderkid). ²⁰⁹
	Engaged research effect	In-depth research collaborations may support engagement of different stakeholders and the development of capacities and relationships that enhance potential impact (e.g. T-CLIRP). ²¹⁰ (This mechanism is only indirectly related to GSMA interventions.)

Whether outputs will lead to outcomes depends on a complex set of interrelated factors. Various factors explain why initiatives are likely to work (or not) and to achieve the intended outcomes (see Table 5).

Table 5: Conditions influencing effectiveness of the GSMA climate innovation model

Category	Factor	Examples
Relevance to climate action ecosystem actors	Government policy	Initiatives that align with national climate and technology policies ²¹¹ have helped to leverage incentives for engagement (e.g. waste management).
	MNOs' ESR policy	MNO ESR policies on agriculture align with GSMA initiatives. ²¹²
	Donors and civil society organisations' (CSOs) policy	GSMA's work on biodiversity aligns with UNDP's environmental priorities. ²¹³
Reaching, influencing and	Technical functionality	Most partners successfully delivered technically functional solutions (e.g. the use of IoT sensors by Aquarech). ²¹⁴ Without this somewhat obvious condition, there is no benefit.

²⁰⁷ KII 3 partners (IF grantees and other start-ups)

²⁰⁸ Evaluator assumptions based on interviews with GSMA staff, partners and reading of reports and policy

²⁰⁹ KII 2 partners

²¹⁰ [Climate change adaptation and livelihood restoration in Tana River Delta: Embracing innovative approaches and technology](#)

²¹¹ Evaluator analysis of policy, KII GSMA staff

²¹² KII MNO

²¹³ [How UNDP and the Kenyan government are collaborating to restore ecosystems | United Nations in Kenya](#), GSMA staff interviews

²¹⁴ [Kenya: Survey reveals private firm sharing clients' data with third parties without consent; Safaricom takes measures to curb unlawful data sharing - Business & Human Rights Resource Centre](#)

Category	Factor	Examples
benefiting target audiences	Political, social and economic factors that create digital barriers	Low mobile penetration, limited digital literacy and issues of trust were key challenges to making the information generated by IoT accessible and useful. Power dynamics related to gender norms are an obvious barrier. Some partners piloted gender-inclusive solutions to address this. ²¹⁵
	Corporate governance (e.g. data breaches)	Allegations made by human rights activists of Safaricom unlawfully sharing customer location data with law enforcement officials may erode confidence and willingness of start-ups and NGOs to partner with Safaricom on climate tech initiatives. ²¹⁶
Financial viability of start-up solutions	MNO commercial priorities	MNO engagement and willingness to work with start-ups and support bundling of financial services is mostly dependent on alignment with commercial goals. ²¹⁷
	MNO ESR priorities	As above.
	Carbon credit market opportunities	CaVEx research suggests that carbon markets are likely to create opportunities for start-ups to increase income. ²¹⁸
	Regulations	Though ultimate impacts on climate outcomes are impossible to predict, government intentions to regulate and generate revenue from carbon credit markets may influence incentives and viability of start-ups. ²¹⁹ Tax policies and other regulations have also challenged rapid expansion of penetration and usage. ²²⁰
Internal and external coherence	Internal collaboration	Poor coordination makes it more difficult to leverage incentives and optimise scale and impact. ²²¹
	External synergies	Greater impact is likely possible by intentionally aligning with incentives of other ecosystem actors (e.g. Taka ni Mali, World Vision). ²²²

GSMA M4D staff are seeking to collaborate more, both internally and with external actors, to exploit GSMA’s niche – its relationship with MNOs. However, this is challenging because of organisational constraints. Examples of successful collaboration include Climate Tech and Digital

²¹⁵ [Kenya’s Digital Economy to Contribute KSH 662 Billion to GDP by 2028, Driven by Policy Reforms - Newsroom](#), KI partner Aquarech engaged in community level activities to try and encourage women’s participation

²¹⁶ [Kenya: Safaricom under fire as Senators demand answers on alleged data breaches - Business & Human Rights Resource Centre](#)

²¹⁷ KIIs MNO and partner

²¹⁸ KII Partner who is a sector expert

²¹⁹ KII Partner

²²⁰ [Kenya’s Digital Economy to Contribute KSH 662 Billion to GDP by 2028, Driven by Policy Reforms - Newsroom](#)

²²¹ Evaluation team analysis of implications of experience during portfolio mapping

²²² The World Vision Kenya project describes an example and expert KIIs also made this point, suggesting GSMA M4D could partner more strategically with the Food and Agriculture Organization of the United Nations (FAO)

Utilities teams working together with Taka ni Mali around waste management. Factors that challenge this potential are described in Table 6.

Table 6: Disabling factors affecting GSMA’s effectiveness in Kenya (EQ2.5)

Factor	Details
No country strategy or country coordination	As there is no country strategy, and no staff member responsible for holding the climate portfolio, it is difficult to identify and coordinate potential for collaboration beyond individual initiatives. ²²³
Lack of strategy-level MEL	There is no central system that tracks all GSMA climate initiatives in Kenya. This makes it difficult to learn about whether, how and why different activities have greater impact than the sum of their parts.
Insufficient engagement with the broader climate ecosystem	There are good examples, such as T-CLIRP and Taka ni Mali, where GSMA is convening and connecting with more actors. Yet strategic relationships with organisations such as FAO could enhance this further. ²²⁴
Inflexible budgets	Grantees could not easily adjust projects after testing due to rigid budgets that lack contingency funds. ²²⁵
Generic technical assistance	Technical assistance was sometimes too broad and not tailored to specific grantee needs ²²⁶ . There was no funding available outside of the Innovation Fund open calls. ²²⁷
Weak learning systems	Some grantees adapted well to their learning, but GSMA’s internal learning and strategy processes do not consistently connect insights across teams or projects. ²²⁸

6. Conclusions and strategic recommendations (EQ3)

GSMA M4D’s climate action innovation approach is policy-relevant and is anticipated to have moderate impacts across climate change mitigation, adaptation, resilience, NRM and environmental sustainability. However, the extent of these impacts varies significantly by context, and it remains challenging to accurately assess the scale of impact on target populations. Although most elements of the approach described in the Climate Impact Narrative have been tested, there has been a

²²³ Evaluation team experience trying to map the portfolio. Although two grantees (Syneffa and Ujuzi Kilimo) were working on similar problems, they were not connected with each other, as one was funded under an Innovation Fund M4D round and the other M4H

²²⁴ The World Vision Kenya project describes an example and expert key informants also made this point, suggesting GSMA M4D could partner more strategically with FAO

²²⁵ Grantee KII

²²⁶ KIIs Grantee

²²⁷ GSMA staff

²²⁸ In several KIIs and casual conversations, GSMA staff described how the combination of a diverse (theme, focus, geographic spread) portfolio of grantees and challenging inter-team coordination made it difficult to find common areas for shared learning. Evaluation team insight based on portfolio mapping and various interviews

stronger focus on enhancing household resilience (including through environmentally sustainable farming practices and increasing access to waste management) than on other areas. The extent to which interventions are impacting (or could impact) communities that are particularly vulnerable to the effects of climate change is currently unclear.

6.1 What GSMA does well

6.1.1 High relevance and strategic alignment

- GSMA's activities align with key national and World Bank priorities in Kenya, including climate-resilient agriculture, urban basic services and climate finance.
- Its activities fit strongly with Kenya's policy focus on digitalisation and green growth.
- Grantees (particularly those focusing on agriculture) respond to priority needs such as use of soil sensors.

6.1.2 Effective convening and connecting for strategic collaboration

- Effective brokering of partnerships between MNOs, start-ups and local actors (e.g. Taka ni Mali and Safaricom) is having ripple effects.
- GSMA's participation in global fora has helped raise grantees and partners' visibility and secure investment (e.g. Aquarech raised US\$1.9 million in equity).

6.1.3 Catalytic funding, technical and relational support

- Grantees and investors value being associated with the GSMA brand, and the opportunity to strengthen professional and financial management skills that de-risk and prepare them to attract investment. They also reported valuing GSMA's technical assistance on sophisticated technological solutions.
- Start-ups such as Aquarech appear to be engaging communities and developing trusted channels to make relevant information accessible and usable, which should enhance farmers' anticipatory and adaptive capacities.
- Support to grantees and partners to explore digital financial models and early carbon market experimentation (e.g. CaVEx, 4R Digital).

6.1.4 Sensitive to issues of gender and inclusion

- Several grantees deployed USSD, IVR or offline training to reach digitally excluded groups (e.g. World Vision Kenya, Ujuzi Kilimo, Syneffa).

6.1.5 Sustainability and natural resource management

- Initiatives in reforestation, land restoration and circular economy education (e.g. T-CLIRP, Taka ni Mali) are innovative, providing important lessons for Climate Tech advocates.

6.2 What GSMA needs to improve

6.2.1 Country strategy, coherence and coordination

- GSMA would benefit from an in-country climate strategy supported by a monitoring, evaluation and learning (MEL) system to align and track projects (see below). Appointing a country coordinator will be essential to make this effective.
- The strategy needs to go beyond what GSMA is comfortable addressing and instead be rooted in a broad analysis of climate vulnerabilities in the Kenyan climate ecosystem. This should explicitly state GSMA M4D's value proposition around its niche and its ability to influence change at scale.

6.2.2 Monitoring, evaluation and learning

- MEL systems should enable GSMA M4D to test its value proposition and track its contributions to country-level change in areas other than the Innovation Fund.
- Outcome harvesting could be more consistently applied; data is not currently collected or used systematically for learning or adaptation.

6.2.3 Government engagement

- Government partnerships, which are mostly indirect and opportunistic, could be strengthened through more deliberate engagement.
- Influence at policy level could be given more emphasis in new country strategy.

6.2.4 Technical assistance

- Generic approaches could be revised so that they are more specific to the needs of grantees.
- More flexible budgets could enable grantees to adapt activities and partners to access funding from GSMA outside of the formal and lengthy system of open calls.

6.3 Strategic recommendations

The following strategic recommendations offer opportunities to amplify strengths and address weaknesses.

6.3.1 Coherent and contextualised country strategy

GSMA should develop a medium-term, integrated country strategy for Kenya that connects mobile innovation to meaningful climate outcomes, particularly targeting the most vulnerable groups and communities as potential beneficiaries of actions taken by other stakeholders. The strategy should be grounded in a clear, localised theory of change informed by climate vulnerability assessments, political economy analysis and mobile ecosystem dynamics. It should make specific assumptions relating to engaging or influencing government actors.

A Kenya Country Coordinator should be appointed, supported by a robust planning and MEL system that enables continuous alignment, tracking and adaptation (see Section 6.3.2 below). This system should serve as the backbone for GSMA's engagement – ensuring strategic coherence across advocacy, brokering, capacity support, research and grant-making.

A context-specific assessment of vulnerabilities, focused on the underlying political, institutional and social causes, might include embedded action research with target communities. Such an approach would ensure that programming reflects vulnerable people's lived realities. Ecosystem mapping could complement this by identifying key actors in both the mobile and climate adaptation spaces. Evidence from Kenya suggests that strategic partnerships – particularly with organisations like World Vision Kenya, local associations representing vulnerable groups (such as smallholder women farmers or urban informal workers) – can enhance the relevance and scalability of interventions.

GSMA must also assess the enabling and constraining factors (at the structural, political and individual levels) that influence the adoption and impact of specific technologies. Solutions should be designed through a process of co-creation with users and stakeholders including strategic partners such as Taka ni Mali, and supported over longer timescales to enhance sustainability and systems change.

6.3.2 Strengthened monitoring, evaluation and learning

MEL systems should prioritise learning and outcomes, beyond technology uptake. A country-level MEL framework should track and synthesise data across activities and the portfolio, enabling

insights into who benefits, how, and under what conditions. This includes measuring resilience capacities, mitigation potential and equitable access.

Embedded research could play a critical role in understanding the impacts of initiatives on producers, consumers, and the broader systems they are part of. This should help to highlight any potential unintended consequences. Tools such as outcome harvesting and process monitoring will support evaluation of key initiatives in areas such as waste management and the circular economy. Insights from this MEL system should feed directly into strategy adaptation, learning, and assessments of the overall innovation model.

Data systems should also enable the tracking of longer-term impacts, including environmental and socioeconomic effects, and where relevant, contributions to carbon emission reductions linked to market mechanisms and interventions such as CaVEx.

6.3.3 Systems thinking and long-term evaluation

GSMA should move toward an accompaniment evaluation model that supports long-term system change. This involves integrating internal learning with periodic external reviews, and situating climate tech evaluations within broader political and ecosystem analyses.

Understanding the systems in which innovations operate will help identify barriers and enablers of scale, ranging from policy environments and market structures to social norms and vested interests. This approach supports more adaptive programming, and will put GSMA in a better position to contribute to transformational change.

6.3.4 Inclusive and scalable innovation

To ensure accessibility, solutions should be designed for low-literacy users, offline functionality, and under-served areas. Lessons from hybrid models that blend digital and in-person delivery such as those being tested by current grantees/ partners, could be adapted to enhance uptake and usability.

Bundling digital solutions with financial services (e.g. credit, insurance, savings) can increase resilience and improve long-term viability. Special attention should be given to inclusive user design, and sustaining reach among historically excluded groups.

6.3.5 Evidence-informed advocacy

GSMA's ability to convene actors around critical climate and environmental challenges (such as waste management) should be linked to stronger, evidence-based advocacy. This requires building on recent success of embedded research that documents and shares results in real-time with policy audiences.

Evidence that is co-produced with partners and communities can have a stronger influence on digital and climate policy. It is also more likely to generate external interest, and support donor engagement. Clear, well-communicated insights into what works in specific contexts, with specific groups, for example waste management could continue to boost GSMA's credibility as a strategic actor in climate and digital development.

6.3.6 Value for money and impact pathways

Finally, the Kenya country strategy must clearly articulate GSMA's value proposition: how GSMA's efforts provide value for money – particularly for funders such as FCDO – by outlining clear assumptions and causal pathways. This includes showing how digital innovation reduces vulnerability, enhances inclusion, and strengthens systems.

By demonstrating how its interventions enable scalable, cost-effective outcomes for vulnerable populations in high-risk environments, GSMA can strengthen the case for sustained investment and cross-sector collaboration.

List of respondents and documents reviewed for Kenya case study

Name	Title	Organisation	Respondent type	Interaction
Annalena Fuchs	Scaling Digital Agriculture Innovations through Start-ups (SAIS)	GIZ	Donor	Key informant interview
Monica Nthiga	Freelance tech, governance and humanitarian consultant	Formerly Regional Director, Eastern and Southern Africa Humanitarian OpenStreetMap and Ushahidi	Expert	Key informant interview
Dickson Ayuka	Cofounder	Ujuzi Kilimo	Grantee	Key informant interview
James Odede	Cofounder and Chief Technical Officer (CTO)	Aquarech	Grantee	Key informant interview
Jon Ridley	Cofounder and Director	4R Digital	Grantee	Key informant interview
Leah Wangu	Grants Coordinator	Syneffa	Grantee	Key informant interview
Marc Decunha	GSMA Project Manager	Farm to Feed	Grantee	Key informant interview
Dickson Marira	Chief Executive Officer (CEO)	Wonderkid	Grantee/Partner	Key informant interview
Alfred Osiko	Senior Market Engagement Manager, Climate Tech	GSMA	GSMA Staff	Key informant interview
James Karanja	Monitoring & Evaluation Analyst	GSMA	GSMA Staff	Key informant interview
George Kibala Bauer	Senior Director, Climate Tech and Digital Utilities	GSMA London	GSMA Staff	Key informant interview, sensemaking session
Leila Guici	Senior Advocacy Manager, Climate Tech	GSMA	GSMA Staff	Key informant interview, focus group, sensemaking session
Zach White	Senior Insights Manager, Digital Utilities	GSMA	GSMA Staff	Key informant interview, focus group
Hector Matthews	Monitoring, Evaluation and	GSMA	GSMA Staff	Key informant interview, focus

	Learning (MEL) Manager, Mobile for Humanitarian Innovation (M4H)			group, sensemaking session
Bryce Hartley	Senior Manager, Strategic Partnerships and Market Engagement	GSMA	GSMA Staff	Key informant interview
Valentine Cheruiyot & James Otemba	Manager, Climate and Environmental Management	Safaricom	MNO	Key informant interview

List of documentation reviewed for Kenya case study

The evaluation team reviewed large quantities of internal GSMA programme and project documentation as part of this case study. We have listed below all internal and external documentation referred to directly in this case study report.

AP News (September 2023) <u>As Africa opens a climate summit, poor weather forecasting keeps the continent underprepared</u>
Awi Ellie. (2023) <u>The State of IoT in Kenya.</u> Medium
Biegon et al. (2024) <u>Budget adaptation? What we know about how Kenya's budget is evolving to tackle climate adaptation.</u> Bajeti Hub and Institute of Public Finance.
Business and Human Rights Resource Centre. (2021) <u>Kenya: Survey reveals private firm sharing clients' data with third parties without consent; Safaricom takes measures to curb unlawful data sharing</u>
Government of Kenya (2023) <u>National Climate Change Action Plan (Kenya) 2023-2027.</u> Ministry of Environment, Climate Change and Forestry, Nairobi, Kenya.
Government of Kenya, Ministry of Environment, Climate Change and Forestry, Nairobi, Kenya. (2023) <u>National Climate Change Action Plan (Kenya) 2023-2027.</u>
Government of Kenya. <u>National Climate Change Action Plan 2018-2022 Second Implementation Status Report for the FY 2019/2022</u>
GSMA <u>M4H 2024 Annual Report</u>
GSMA. (2021) <u>Mobile Technology for Participatory Forest Management: Co-designing and testing prototypes in Kenya Mobile for Development</u>
GSMA. (2022) <u>Mobile for Humanitarian Innovation Annual Report</u>
GSMA. (2022) <u>Catalysing Partnerships in Plastics - Exploring the Potential for Collaboration between Mobile Network Operators and Plastics Organisations</u>
GSMA. (2025) <u>Highlights from the GSMA Digital Urban Utilities Forum on Waste Management in Nairobi Mobile for Development</u>
GSMA. (2025) <u>Kenya's Digital Economy to Contribute KSH 662 Billion to GDP by 2028, Driven by Policy Reforms - Newsroom</u>
GSMA. (May 2023) <u>Climate change adaptation and livelihood restoration in Tana River Delta: Embracing innovative approaches and technology</u>
GSMA. <u>Aquarech CRA Fund Final Reporting</u>
GSMA. <u>Aquarech endline report</u>
GSMA. <u>Farm To Feed Mobile for Development</u>

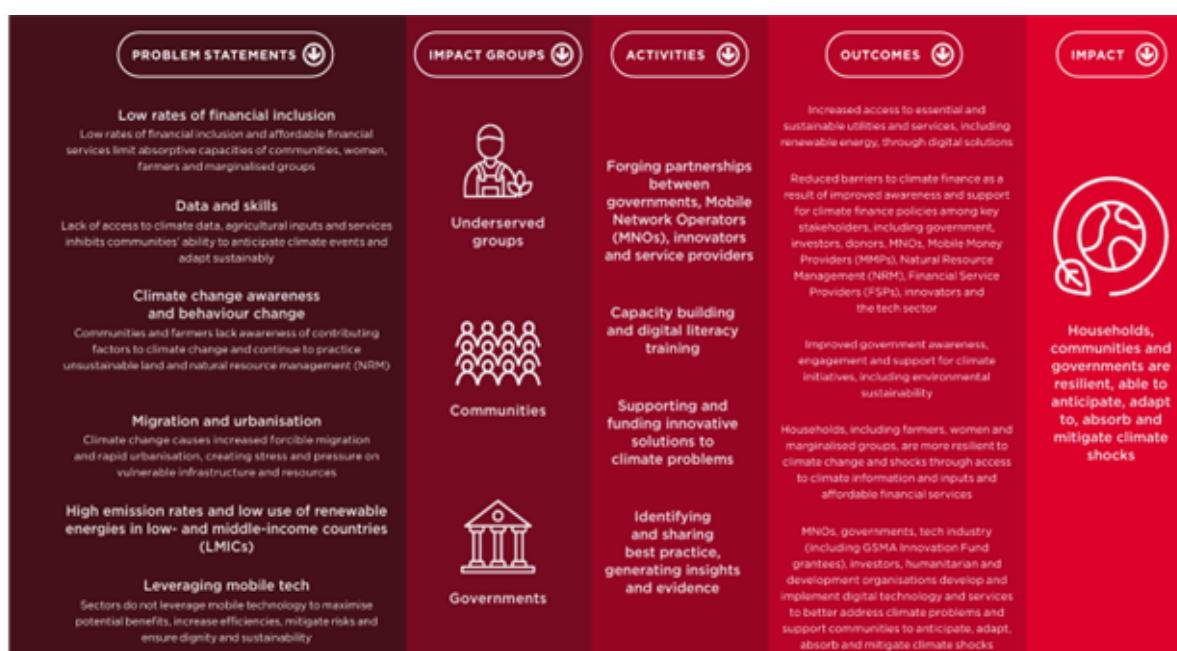
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World Bank. (2024) Financial Inclusion in Sub-Saharan Africa—Overview

Annexe 7: GSMA formative evaluation – Pakistan case study

1. Introduction

This case study summarises findings from research on initiatives implemented by GSMA’s Mobile for Development (M4D) and Mobile for Humanitarian Innovation (M4H) programmes in Pakistan, which form part of a portfolio later framed within a Climate Impact Narrative (see Figure 1). As the activities were not guided by an overarching country-level strategy, and the evaluation team lacked information on GSMA’s plans in Pakistan, it is not a strategy review; we offer no country-specific recommendations in terms of a thematic or technology focus. Rather, strategic recommendations relate to ways of working to enhance impact.

Figure 1: GSMA’s Climate Impact Narrative



Source: GSMA Mobile for Development Climate Impact Narrative, GSMA 2023.

The methodology used to conduct this case study is described in the main evaluation report. It speaks mainly to evaluation question (EQ)2 in the overall evaluation design: *Testing the GSMA M4D climate tech ‘use case’ or theory of action: how, why and to what extent is GSMA’s M4D climate approach likely to have anticipated impacts in areas of climate change mitigation, adaptation, resilience, natural resource management (NRM) and environmental sustainability for target populations?*

We begin by outlining the context for GSMA’s climate actions in Pakistan, assessing how well its problem analysis aligns with relevant policy frameworks, and the broader enabling environment for climate tech (Section 2). Section 3 examines the relevance of GSMA M4D’s climate initiatives to government priorities and assesses their internal coherence. Section 4 maps evidence of progress across the outcome areas defined in the Climate Impact Narrative, while Section 5 explores how, why and to what extent GSMA’s innovation model is functioning effectively. Section 6 summarises key strengths and areas for improvement to enhance GSMA’s impact on climate change mitigation, adaptation, resilience, NRM and environmental sustainability for target populations. We present

some general recommendations here, but there is more detailed guidance presented under EQ3 in the main evaluation report.

2. Context

Pakistan makes a small contribution to total global greenhouse gas (GHG) emissions but it is among the countries most vulnerable to climate change. It was ranked fifth on the 2020 Global Climate Risk Index of the most vulnerable countries.²²⁹ Hazards exacerbated by climate change include floods, droughts, heatwaves, landslides and wildfires.²³⁰ These events disrupt agriculture, infrastructure and economic stability, and endanger people’s lives and livelihoods, especially people living in poverty or who are otherwise vulnerable.²³¹ For instance, recent flood, heatwaves and shifting rainfall patterns have reduced crop yields, leading to increased food insecurity.²³² Sea-level rises threaten coastal settlements,²³³ while deforestation, poor waste management and industrial pollution further degrade the environment.²³⁴

Vulnerability to climate-related hazards in Pakistan varies, and is shaped by socioeconomic, geographic and institutional factors that lead to the challenges outlined in GSMA’s problem analysis. Exposure to climate risks varies across regions due to differences in topography and meteorological conditions.²³⁵ Vulnerability among population groups is further shaped by structural inequalities, gender norms, wealth and income disparities, age, and unequal access to institutions and services.²³⁶ These factors, recognised in both Pakistan’s 2021 National Climate Change Policy and the 2023 National Adaptation Plan, align with GSMA M4D’s analysis of barriers to the use of technology for effective climate tech solutions (Table 1).

Table 1: Barriers to climate action caused by structural causes of climate vulnerability

GSMA M4D’s analysis of barriers	Examples cited in Pakistan policies
<i>Low financial inclusion and affordable financial services</i>	Only 2.4% of the population have access to credit from formal financial sources; 53% of the adult population are financially excluded. ²³⁷
<i>Lack of access to relevant climate data skills and resources</i>	Improved weather and climate data, and equipping people with the skills to interpret and use this data effectively, has been identified as a priority, usually in respect of early warning systems (EWS). ²³⁸
<i>Low awareness of causes of climate change at community level</i>	Communities and farmers lack awareness of the factors that contribute to climate change, and continue to practice

²²⁹ World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series;. © World Bank, Washington, DC. <http://hdl.handle.net/10986/38277> License: [CC BY-NC-ND](#)." [World Bank Document](#), [Pakistan NAP 2023](#)

²³⁰ [Pakistan Country Report 2023 B5 final.cdr](#), [Revised Pakistan 2022 Floods Response Plan Final Report \(Issued 15 Dec 2023\) | OCHA](#)

²³¹ GSMA CR BKK Baseline Report

²³² ²³² "World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series;. © World Bank, Washington, DC. <http://hdl.handle.net/10986/38277> License: [CC BY-NC-ND](#)." [World Bank Document](#)

²³³ "World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series;. © World Bank, Washington, DC. <http://hdl.handle.net/10986/38277> License: [CC BY-NC-ND](#)." [World Bank Document](#). p3

²³⁴ ²³⁴ "World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series;. © World Bank, Washington, DC. <http://hdl.handle.net/10986/38277> License: [CC BY-NC-ND](#)." [World Bank Document](#)

²³⁵ [Pakistan NAP 2023](#)

²³⁶ [Pakistan NAP 2023](#)

²³⁷ <https://www.sbp.org.pk/finc/FL.asp>

²³⁸ https://unfccc.int/sites/default/files/resource/National_Adaptation_Plan_Pakistan.pdf

	unsustainable land and natural resource management (NRM). ²³⁹
<i>Climate change contributes to migration and urbanisation</i>	According to the National Climate Adaptation Plan, 'The inequality that characterizes Pakistan's rapid urbanization, and its lagging urban services, exacerbate vulnerability to disaster and climate change impacts.' ²⁴⁰
<i>High emission rates and low use of renewables</i>	Pakistan seeks to conserve energy, improve energy efficiency and optimise fuel mix to support global efforts for reduction in GHG emissions. ²⁴¹ However, the more pressing task is to prepare itself for adaptation to climate change.
<i>Sectors do not leverage mobile tech to address climate change problems:</i>	Pakistan lacks weather data stations, depriving vulnerable communities (particularly farmers on low incomes or with smallholdings) of hyper-local weather information. ²⁴²

GSMA's Climate Tech initiatives operate within a rapidly evolving and complex environment in Pakistan. Despite governance and regulatory challenges, the country has signalled increasing political and institutional commitment to climate action and digital transformation. This has been enabled by international donors (e.g. the UK Foreign, Commonwealth and Development Office (FCDO) and the World Bank), non-governmental organisations (NGOs), and a growing domestic tech sector. Key developments include the following:

- **National policies and plans:** Pakistan's 2021 National Climate Change Policy, Nationally Determined Contribution and 2023 National Adaptation Plan all indicate a whole-of-economy approach to addressing challenges posed by climate change.²⁴³ These align with international frameworks such as the Paris Agreement and the Sustainable Development Goals (SDGs), and have set ambitious targets.
- **Government engagement:** Key individuals in leadership roles, including the Information Technology (IT) Minister and officials in the National Disaster Management Authority (NDMA), recognise the role of digital and mobile tech in adaptation.²⁴⁴ Policies encouraging mobile penetration, digital inclusion and e-learning platforms are positioning mobile technology as a key enabler of climate adaptation and sustainable development.²⁴⁵
- **Technology readiness and an improving enabling environment:** Mobile broadband coverage expanded dramatically from 15% in 2010 to 80% in 2022, and smartphone penetration rose to 63% over the same period.²⁴⁶ A growing number of citizens are using technology for digital financial services. The four main MNOs (Telenor Pakistan, Jazz, Zong and Ufone) have an environmental and social responsibility (ESR) agenda supportive of development.²⁴⁷ GSMA supports these MNOs – for example, by advocating for government to address the barriers to the spread of digital technology (including taxes, smartphone costs and poor exchange rates, which limit profitability).

²³⁹ [NCCP Report.pdf](#), page 42

²⁴⁰ National Climate Adaptation Plan, page 5

²⁴¹ [NCCP Report.pdf](#), page 4

²⁴² [Climate-Tech Startups Shaping Pakistan's Future](#)

²⁴³ Pakistan Ministry of Climate Change (2021), National Climate Change Policy

²⁴⁴ [The Transformative Role of Information Technology in Pakistan - Stratheia](#), Ministry of Climate Change (2017) [Pakistan: Climate Adaptation Technology Action Plans & Ideas](#)

²⁴⁵ [Pakistan: Climate Adaptation Technology Action Plans & Ideas](#)

²⁴⁶ [Making Digital Pakistan a reality](#)

²⁴⁷ KIIs MNO, GSMA M4D staff and Partner (IF Grantee)

- **Universal Service Fund:** As in many countries, a Universal Service Fund (financed by MNO taxes) provides incentives that actors such as GSMA can use to encourage these MNOs to contribute to social development initiatives that lack a business case.²⁴⁸
- **Government support for green growth:** A green tech hub aimed at fostering innovation in sustainable technologies positions climate action and climate finance as a driver of green growth.²⁴⁹ The NDMA supports integrating technology into disaster management and development, promoting sustainable, innovative solutions.²⁵⁰ In 2024, Pakistan launched a National Climate Finance Strategy to address its US\$348bn climate finance gap, and a National Carbon Market policy soon followed.²⁵¹
- **Climate action ecosystem:** There is now considerable public and political discourse on climate change and the environment (particularly in relation to urban populations), and there is an extensive and diverse ecosystem of actors engaged with climate actions.²⁵² These include international development partners (and the programmes they fund), international, national and local NGOs and faith-based organisations, other social movements, academic organisations and media.

Despite a generally positive enabling environment, Pakistan’s political economy exacerbates climate vulnerabilities and also poses challenges to addressing them. Pakistan lags its neighbours on social and political indicators, and regional inequality is rooted in authoritarian governance favouring elites and the military.²⁵³ Likewise, climate policy is shaped by institutional power dynamics, with high-emission sectors, protected by elite interests, dominating.²⁵⁴ Laws restricting GIS mapping, internet shutdowns, and other regulatory issues hinder climate action.²⁵⁵ Political instability (such as the disruption following Imran Khan’s ousting in April 2022) has further interrupted progress.²⁵⁶

3. Relevance and coherence of GSMA M4D’s climate actions (EQ2.1 and EQ2.4)

GSMA M4D’s activities are highly relevant. Team members based in London and Pakistan, from GSMA M4D Climate Tech, Innovation Fund, Digital Utilities, and the Central Insights Unit (CIU), together with GSMA Mutual and supported by a coordinator based in India, have implemented at least 10 initiatives²⁵⁷ that address key challenges identified in the Climate Impact Narrative. These are directly relevant to the Pakistan policy context: they seek to address issues that exacerbate people’s vulnerabilities to hazards in line with government adaptation priorities.

Table 2: Mapping GSMA M4D’s climate actions against policy priorities

Government policy priorities	GSMA M4D Climate Action initiatives
Transforming the agriculture food system including by promoting climate-smart practices and improved water and land management. ²⁵⁸	BaKhabar Kissan (BKK) (supported by the Innovation Fund) provides Internet of Things (IoT)-supported free weather updates and sells customised information services (with online and offline components) for farmers. With GSMA funding, BKK expanded its climate-smart services, deploying 155 weather stations for hyper-local forecasts. This enabled personalised climate data and advice to help farmers adapt, anticipate and manage climate-related risks. ²⁵⁹

²⁴⁸ KII GSMA Mutual

²⁴⁹ [Pakistan unveils first National Climate Finance Strategy](#)

²⁵⁰ [NDMA Pakistan \(2025\). National Disaster Risk Reduction Strategy 2025 – 2030, Pakistan. National Disaster Management Authority, Islamabad, Pakistan.](#)

²⁵⁸ Pakistan National Adaptation Plan, page 48

²⁵⁹ [Leveraging Digital Technology for Climate-Smart Farming in Pakistan: BKK | Mobile for Development](#)

	<p>CROP2X (supported by the Innovation Fund) has similar aims to BKK. GSMA provided support to increase productivity and environmentally sustainable farming practices through new features supported by IoT. These raise awareness on the risks of climate change and provide climate data so farmers can adapt, addressing inefficiencies such as water wastage and excessive fertiliser use through better real-time crop health monitoring.²⁶⁰</p> <p>The Pakistan Agricultural Research project (supported by Digital Utilities) (and supported under the Smart Villages programme, Gokina) undertook community-based research and delivered a training course to make farmers more aware of climate change and water-efficient agriculture processes. It was cut short due to political instability in 2022.²⁶¹</p>
<p>Building climate-resilient cities – improving municipal service delivery²⁶²</p>	<p>Lahore Waste Management Company: GSMA’s Digital Utilities team collaborated with the company to pilot IoT and artificial intelligence (AI) smart bins to improve the efficiency of waste management in ways that reduce emissions from bin collection processes.²⁶³</p> <p>Public-private partnerships for urban services (Digital Utilities). In 2022, the team convened a multi-stakeholder workshop in partnership with the National Incubation Centre. It included discussions around pressures on urban services due to rapid urbanisation, climate change and urban inequality. Public-private partnerships were proposed to advance climate-tech investment; waste, sanitation; and clean cooking.²⁶⁴</p>
<p>Early warning systems – strengthening hydromet, climate and early warning systems (EWS) and services²⁶⁵</p>	<p>Buraq (an Innovation Fund grantee) shares weather information with government/NDMA agencies to enhance anticipatory capacities. GSMA’s funded 14 new weather stations for a cloud-based, personalised EWS service using 4G-enabled phone sets. One objective is to facilitate more analysis of weather data from various sources relating to different hazards, including snow avalanches and landslides.²⁶⁶</p>

²⁵³ [Pakistan: An interesting paradox of growth without development | SOAS,](#)

²⁵⁴ [Climate action and political economy in Pakistan | International Growth Centre](#)

²⁵⁵ Pakistan researcher Contextual Knowledge

²⁵⁶ As was the case for the GSMA Smart Villages programme where activities ceased following the transition

²⁵⁷ The Evaluation team were able to identify 10 climate initiatives in/related to Pakistan in our mapping of the GSMA Climate portfolio. However, due to the fragmented nature of the climate portfolio across multiple teams there may have been some which were not included.

²⁵⁸ Pakistan National Adaptation Plan, page 48

²⁵⁹ [Leveraging Digital Technology for Climate-Smart Farming in Pakistan: BKK | Mobile for Development](#)

²⁶⁰ [Crop2X | Mobile for Development](#)

²⁶¹ Outcome Harvest Learning report based on Smart Village Pakistan Outcome Map: reference the associated PowerPoint Slide #12.), KII GSMA Staff

²⁶² National Climate Adaptation Plan priority, page 49

²⁶³ KII GSMA Staff, KII Partner

²⁶⁴ [Pressure on urban services](#)

²⁶⁵ National Climate Adaptation Plan priority, page 59

²⁶⁶ KII Partner [Buraq Integrated Solutions | Mobile for Development](#)

	<p>Forest fire management (FCDO-CIU): Building on previous initiatives implemented by the World Wide Fund for Nature (WWF) Pakistan in partnership with Lahore University of Management Sciences (LUMS) and supported by FCDO, GSMA's CIU led a project to sensitise regulators and other stakeholders on the potential of AI for mitigating and managing the risk of forest fires.²⁶⁷</p> <p>Early Warning for All (EW4All) and Humanitarian Connectivity Charter: GSMA was a key actor in a national multi-stakeholder workshop to evaluate the state of EWSs, and examine the implications of the Humanitarian Connectivity Charter.²⁶⁸ Participants explored opportunities for mobile technologies to contribute to a national EW4All.²⁶⁹</p>
Natural capital and air – reducing emissions ²⁷⁰	Ecofire aimed to promote clean cooking stoves to address emissions (Smart Villages programme, Gokina). ²⁷¹
Human capital – Mainstreaming climate adaptation in health and education, and enhancing climate resilience through disaster emergency preparedness and response, including greater use of digital technology ²⁷²	Smart Villages, EW4All, Humanitarian Connectivity Charter and AI Forest Fire systems all incorporate components that build human capital and improve systems, including use of digital technology. ²⁷³
Gender youth and social inclusion – supporting vulnerable groups to strengthen their capacity for disaster risk management (DRM) and climate-resilient livelihoods and encouraging participation in planning	GSMA's support for climate action in Pakistan seems to have benefited from gender considerations. Women were key beneficiaries of the Smart villages intervention; ²⁷⁴ Buraq decided to include interactive voice response (IVR) functionality at the suggestion of GSMA and was able to explain why this was important for women; ²⁷⁵ both BKK and CROP2X initiatives explored approaches to increasing access for women farmers. ²⁷⁶
Electricity efficiency – though not related to adaptation, government has prioritised increasing the efficiency of	SB Electronics Engineering and Control (Pvt) Ltd. (SBEEC) conducted research with smart meters to improve efficiency in electricity usage at the school that was

²⁶⁷ KII Donor, KII GSMA staff

²⁶⁸ KII APAC Staff

²⁶⁹ [Mobile-powered Early Warning Systems key to disaster preparedness: Jazz CEO](#)

²⁷⁰ National Climate Adaptation Plan priority Page 44

²⁷¹ Outcome Harvest Learning report based on Smart Village Pakistan Outcome Map: reference the associated PowerPoint Slide #12.), KII GSMA Staff

²⁷² National Climate Adaptation Plan priority

²⁷³ Evaluation Team analysis

²⁷⁴ KII GSMA Mutual

²⁷⁵ KII Partner (IF Grantee)

²⁷⁶ KII Partner (IF Grantee)

electricity usage that has emissions benefits ²⁷⁷	educating women on themes including financial inclusion (Smart Villages programme). ²⁷⁸
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There is growing internal coherence among GSMA M4D initiatives in Pakistan promoting digital tech to improve how climate information is generated, distributed and used:

- *Agriculture*: interventions by BKK, CROP2X and Buraq complement each other and have potential for wider impact on agriculture productivity, including through linkages with the Smart Villages programme.
- *Early warning systems*: Buraq, AI Forest Fires, EW4All and the Humanitarian Connectivity Charter initiatives all aim to improve EWSs. GSMA has deliberately included BKK and Crop2X in some activities offering opportunities for partners to connect and explore synergies and alignment.²⁷⁹
- *Digital Utilities*: It is more challenging to identify a coherent Digital Utilities strategy on climate action in Pakistan, partly because political instability interrupted implementation.²⁸⁰

4. Contributions to expected outcomes (EQ2.3 and EQ2.4)

There is evidence that GSMA initiatives are enhancing government awareness and fostering connections among stakeholders to adopt climate tech. Promising outcomes are emerging in terms of building anticipatory and absorptive capacities at household and community levels. Impacts on adaptive capacity and extreme vulnerability are limited.

Table 3: Mapping progress on outcomes against the Climate Impact Narrative

GSMA outcome area	Progress to date ²⁸¹
MNOs, governments, tech industry (including GSMA Innovation Fund grantees), investors, humanitarian and development organisations develop and implement digital technology and services to better address climate problems and support communities to anticipate, adapt, absorb and mitigate climate shock	<p>GSMA financial, technical and relational support has enabled various actors to experiment and/or learn about new potential mobile use cases for climate action and their roles within them; some have begun to develop new relationships while others are attracting additional investment to scale efforts – for example:</p> <ul style="list-style-type: none"> • MNOs: GSMA involved Telenor Pakistan and Jazz in the Smart Villages programme and PTA, Zong and Jazz offered to install towers in the AI Forest Fires case despite there being no business case • Government: various actors in AI Forest Fires and EW4All, Capital Development Authority • Tech industry: Onebyte, Ecofire, SBEEC, BKK, CROP 2X, and Buraq in a range of initiatives • Investors/funders: USF, FCDO, ADB, Gobu Ventures • Humanitarian and development organisations: WWF Pakistan, UNDRR, IFRC in EW4All, WaterAid, • Academic organisations: LUMS

²⁷⁷ [Energy Efficiency & Conservation Strategic Plan 2020-23 by National Energy Efficiency and Conservation Authority NEECA - Climate Change Laws of the World](#)

²⁷⁸ KIIs 2 GSMA staff, GSMA Outcome Harvest Learning report

²⁷⁹ KII Partners (IF Grantee)

²⁸⁰ Interviews

²⁸¹ Sources of evidence for this mapping can be found in Annex 9 that collates the primary sources of evidence used in our analysis of whether how and why different initiatives are progressing towards outcomes.

	<ul style="list-style-type: none"> • Collaborations among MNOs, start-ups, NGOs, and government (e.g. Buraq and NDMA, LUMS and WWF).
<p>Improved government awareness, engagement and support for climate initiatives, including environmental sustainability</p>	<p>EW4All Humanitarian Connectivity Charter fostered cross-ministerial and MNO dialogue, contributing to new memoranda of understanding (MoUs), action plans and interest in humanitarian EWSs. Key stakeholders (including the United Nations Office for Disaster Risk Reduction (UNDRR), the International Federation of Red Cross and Red Crescent Societies (IFRC), the World Meteorological Organization (WMO) and the International Telecommunication Union (ITU)) agreed to collaborate on mobile-enabled humanitarian EWSs. GSMA made some contribution to advancing this agenda, although it was not possible to define it precisely.</p> <p>The AI Forest Fires Initiative catalysed national policy dialogue, bringing together government, FCDO, USF and MNOs to explore collaborative action. GSMA's CIU published a blog and report in 2024, <i>Combatting Forest Fires with AI in Pakistan</i>, integrating insights with global lessons. Activities helped secure provincial buy-in, plausibly influencing Punjab's NDMA tender for an AI-based forest fire mitigation solution. Although achievements built on contributions from other actors, GSMA's convening power, embedded research and technical input were pivotal. Without its support, MNO collaboration – despite limited commercial incentives – would have been unlikely (e.g. AI Forest Fire towers).</p> <p>Buraq reports to have persuaded 85 government agencies to share information in its cloud, but we have no further information on this.</p> <p>Green Growth strategy: GSMA is also credited as having influenced the government's Green Growth strategy.</p> <p>Smart Villages: GSMA supported the revival of tech-related interventions following political instability (see below).</p>
<p>Reduced barriers to climate finance as a result of improved awareness and support for climate finance policies among key stakeholders</p>	<p>There has been no deliberate work on climate finance.</p> <p>BKK is experimenting with carbon credits for community resilience. However, there is no evidence that this was supported by the GSMA grant.</p>
<p>Increased access to essential and sustainable utilities and services, including renewable energy, through digital solutions</p>	<p>There is no evidence that GSMA's Digital Utilities initiatives contributed to increased access to services. Of the three initiatives started under the Smart Villages programme, only SBEEC progressed to achieve results.</p> <p>SBEEC identified electricity theft and misuse in schools using smart meters. The pilot informed an energy-saving model shared with USF. Results were reportedly shared in Nepal, though this could not be verified.</p> <p>Ecofire and Pakistan Agricultural Research (PAR) projects stalled during political instability. Following the political transition, GSMA renewed support, with its management visiting Gokina alongside representatives from ITU, Ministry of Information</p>

	<p>Technology and Telecommunications (MITT) and USF. This led to the MITT launching activities in a second village in December 2024, with plans to expand to a third site.</p> <p>Lahore Waste Management Company Smart Bins: saw limited uptake due to technical issues and weak local buy-in.</p>
<p>Households, including farmers, women and marginalised groups, are more resilient to climate change and shocks through access to climate information and inputs and affordable financial services</p>	<p>BKK customers increased their anticipatory and adaptive capacities due to hyper-local weather information and climate-smart agricultural advice, with potential for wider community benefit. Despite scaling and a massive increase in subscribers resulting from GSMA's support with MNOs, investment in training women and experiments with IVR, it was challenging to establish a commercially viable pricing structure to reach vulnerable farmers. BKK aims to address this by bundling financial services. MEL data on impacts on consumers of farm products was not available.</p> <p>CROP2X accelerated the development of IoT soil probes and a GIS platform thanks to GSMA. A test of IoT-based soil monitoring helped young tech-savvy farmers plan irrigation and monitor crop health. Participants reported up to 50% water savings and 30% yield gains. However, adoption lagged among less tech-literate farmers. Misaligned grant phasing and weak government support slowed broader rollout and scaling.</p> <p>Buraq valued GSMA 's support for new relationships and more robust financial and accounting systems. However, it was not confident of ability to achieve the scale necessary for MNO partnership.</p> <p>EW4All and AI Forest Fires have the potential for greater impact on vulnerable individuals and households at community level.</p>
<p>More sustainable natural resource management (NRM) and environmental sustainability</p>	<p>Sustainable NRM was not a strong focus, but there appears to be some progress: Smart agriculture practices promoted by CROP2X and BKK have demonstrated that under certain conditions they can reduce water and fertiliser misuse.</p>

5. Conditions influencing outcomes and impacts (EQ2.4 and EQ2.5)

GSMA's innovation model works well by leveraging incentives and building capacities that have resulted in valued outputs. Partners in Pakistan generally view GSMA's insight reports, Innovation Fund grant-making, and capacity-building and convening efforts as a strong offer.²⁸² Despite limited progress in urban utilities, climate finance and NRM outcome areas, it is still possible to conclude that GSMA M4D's Innovation Fund, partnership support and capacity-building contribute to raising government awareness and increased support for (or use of) digital tech for climate action. The role of insight reports in triggering climate action is more complicated. Big flagship reports do not

²⁸² KIIs MNO, donors, 3 grantees

seem to inspire actors,²⁸³ whereas engaging actors in more embedded research and co-creation around the Forest Fires management appears promising.²⁸⁴

Our exploration of why GSMA M4D and GSMA Asia Pacific (APAC) staff were successful in engaging actors in activities that resulted in quality outputs and intermediate outcomes revealed the following causal mechanisms (see Table 4). These confirm implicit or explicit assumptions in the innovation model.

Table 4: How the GSMA M4D climate action innovation model has worked in Pakistan

Area	Key factor	Details
Catalytic funding and support to start-ups	Technical capacities	GSMA builds capacity to develop innovative solutions, improve operational professionalism, and strengthen financial management. ²⁸⁵
	Relational capacities	GSMA enhances start-up legitimacy by fostering relationships with MNOs. For some, this can enable integration with mobile financial services, customer base growth, and access to carbon credit markets. ²⁸⁶
Stakeholder convening and strategic collaboration	Commercial incentives	MNOs are motivated by ESR goals, brand enhancement, use of their core services, and customer outreach opportunities. ²⁸⁷
	Relational incentives	Multi-stakeholder approaches foster innovation, diverse collaboration, and strengthened networks across the climate action ecosystem – for example, on the Humanitarian Connectivity Charter in EW4All and AI Forest Fires ²⁸⁸
	Policy incentives	Government actors and donors participate in GSMA events to align with and advance their climate and technology policy agendas – for example, on AI Forest Fires and public-private partnership discussions. ²⁸⁹
Identifying and sharing best practice	Engaged research effect	Participatory research collaborations, such as discussions around the AI Forest Fires, appear to offer an effective approach to research. ²⁹⁰

²⁸³ KII GSMA staff

²⁸⁴ KII Partner (IF Grantee)

²⁸⁵ KIIs 3 Partners (IF Grantees)

²⁸⁶ KII 2 Partners (IF Grantees)

²⁸⁷ KIIs MNO, 1 Partner (IF Grantee), GSMA staff

²⁸⁸ Evaluation Team interpretation of feedback from and participation of grantees and other partners in EW4All and Forest Fire Initiatives

²⁸⁹ KII donor, GSMA Mutual and M4D staff

²⁹⁰ Results of discussion appear to have influenced Punjab NDMA tendering to advance AI solutions.

Whether outputs will lead to outcomes depends on a complex set of interrelated factors.

Various factors explain why initiatives are likely to work (or not) and to achieve the intended outcomes (see Table 5).

Table 5: Conditions influencing effectiveness of the GSMA climate innovation model

Category	Factor	Details
Relevance to climate action ecosystem actors	Government	Initiatives aligned with national climate and technology policies; GSMA built strong relationships across administrations and contributed to government-led efforts. ²⁹¹
	MNOs	MNO environmental and social responsibility (ESR) policies aligned with GSMA initiatives – for example, Jazz is committed to financial inclusion and women’s empowerment; ²⁹² whereas Zong’s corporate social responsibility (CSR) agenda includes supporting disaster relief. ²⁹³
	Donors and CSOs	AI Forest Fires initiatives added value to existing efforts. ²⁹⁴
Reaching and influencing target audiences	Technical functionality	Most partners successfully delivered technically functional solutions. ²⁹⁵
	Digital barriers	Low mobile penetration, limited digital literacy, and trust issues were key challenges; addressed partly through IVR. ²⁹⁶
	Gender norms	Power dynamics limited benefits to women; some partners piloted gender-inclusive solutions. ²⁹⁷
	Local legitimacy	Government endorsement critical for community trust. CROP2X struggled to engage communities without this. ²⁹⁸
	Political disruption	2022 instability led to the stalling of several initiatives. ²⁹⁹ These included work on public–private partnerships, perhaps because Imran Ghazali, the Official Government Spokesperson for Digital Media who was a key

²⁹¹ GSMA Mutual, GSMA staff. Evidence of ongoing government engagement, e.g. in recent discussions on reinvigorating the SMART Villages programme

²⁹² [Jazz Pakistan | Mobile for Development](#)

²⁹³ [Corporate Social Responsibility - Zong 4G Pakistan](#)

²⁹⁴ KII Donor

²⁹⁵ [Leveraging Digital Technology for Climate-Smart Farming in Pakistan: BKK | Mobile for Development](#), KIIs 2 Partners (IF Grantee)

²⁹⁶ KII Partner (IF Grantee)

²⁹⁷ KII Donor

²⁹⁸ KII Partner (IF Grantee)

²⁹⁹ KIIs 2 GSMA Pakistan Staff

Category	Factor	Details
		speaker at a GSMA 2021 event on public-private partnerships , left his post soon after. ³⁰⁰
	State surveillance	Crackdowns on GIS and concerns re surveillance posed risks to digital innovation. ³⁰¹
Financial viability of solutions	MNO commercial priorities	MNO engagement dependent on alignment with commercial goals. Buraq did not anticipate its solution having sufficient scale for a partnership. ³⁰² BKK had more potential because it could bundle financial services.
	USF incentives	GSMA leveraged USF (from MNO tax revenue) to support non-commercial initiatives. ³⁰³
	Regulatory barriers	GSMA's Digital Nation advocacy highlights restrictive MNO regulations that hinder profitability and mobile access. ³⁰⁴
Internal and external coherence	Internal collaboration	GSMA's organisational structure posed challenges, but collaboration and efforts by individual staff illustrated potential to amplify impact. ³⁰⁵
	External synergies	EW4All and AI Forest Fires work suggests that greater impact is possible by aligning with other ecosystem actors (e.g. FAO, WWF, LUMS, UN). ³⁰⁶

GSMA M4D and GSMA Mutual staff who leveraged personal relationships and political awareness to respond to contextual challenges and staff churn were constrained by several organisational factors. GSMA staff with experience or connections in government and business were able to 'work politically' to navigate complex situations.³⁰⁷ Their political savvy helped leverage opportunities like the USF to ensure MNO involvement in several projects.³⁰⁸ However, a number of organisational constraints reduced their potential efficacy (see Table 6).

³⁰⁰ (7) Imran Ghazali | LinkedIn

³⁰¹ KII Donor

³⁰² KII Partner (IF Grantee)

³⁰³ KII GSMA Mutual

³⁰⁴ GSMA (2024) [Realising Pakistan's Aspiration to become a Digital Nation](https://www.gsma.com/about-us/regions/asia-pacific/gsma_resources/digital-nation-pakistan)
https://www.gsma.com/about-us/regions/asia-pacific/gsma_resources/digital-nation-pakistan

³⁰⁵ KIIs 2 GSMA staff

³⁰⁶ Evaluation Team interpretation of KIIs GSMA staff, 1 Partner (IG Grantee) 1 other Partner,

³⁰⁷ A TWP approach has three core principles: strong political analysis, insight and understanding; detailed appreciation of, and response to, the local context; and, flexibility and adaptability in program design and implementation. See <https://twppcommunity.org/about-us/what-is-twp>

³⁰⁸ 2 KIIs GSMA staff

Table 6: Disabling factors affecting GSMA’s effectiveness in Pakistan (EQ2.5)

Factor	Details
Country strategy	There is no country strategy informed by analysis of climate vulnerabilities, political economy, gender norms, and other actors in the climate ecosystem to guide a coherent or coordinated approach (internally and externally). ³⁰⁹
Organisational presence	Limited in-country staffing following the departure of a Digital Utilities team member reduced GSMA’s ability to respond during political disruptions (e.g. follow-up in Gokina stalled during the political hiatus). ³¹⁰
Lack of MEL and coordination	There is no central system that tracks all GSMA climate initiatives in Pakistan. Staff were sometimes unaware of others’ roles or actions, reducing their effectiveness. ³¹¹
Inflexible budgets	Grantees could not easily adjust projects after testing due to rigid budgets that lacked contingency funds. ³¹²
Generic technical assistance	Technical assistance was sometimes too broad and not tailored to specific grantee needs. ³¹³
Weak learning systems	Some grantees adapted well (e.g. BKK), but GSMA’s internal learning and strategy processes do not consistently connect insights across teams or projects. ³¹⁴

6. Conclusions and strategic recommendations (EQ3)

GSMA M4D’s climate action innovation approach is policy-relevant and anticipated to have moderate impacts across climate change mitigation, adaptation, resilience, NRM and environmental sustainability. However, the extent of these impacts varies significantly by context, and it remains challenging to accurately assess the scale of impact on target populations. Although most elements of the approach described in the Climate Impact Narrative have been tested, there has been a stronger focus on enhancing household resilience (including through environmentally sustainable farming practices and EWSs that increase anticipatory capacity) than on other areas. The extent to which interventions are impacting (or could impact) communities that are particularly vulnerable to the effects of climate change is currently unclear.

³⁰⁹ 2 KIIs GSMA staff

³¹⁰ KII GSMA staff

³¹¹ Evaluation team insights based on portfolio mapping efforts

³¹² KIIs Partner (IF Grantee)

³¹³ KIIs Partner (IF Grantee)

³¹⁴ Evaluation Team insight based on portfolio mapping and various interviews

6.1 What GSMA does well

6.1.1 Relevance and strategic alignment

- GSMA's initiatives align with Pakistan's national climate and digital policies, and the priorities of development partners.
- Innovation Fund grantees (e.g. BKK, CROP2X, Buraq) address real climate adaptation needs identified in National Adaptation Plans, especially in agriculture and EWSs.

6.1.2 Effective convening and connecting for strategic collaboration

- GSMA effectively leverages incentives, relationships and funding (e.g. with USF and MNOs) through a politically aware, gender-informed 'thinking and working politically' approach.
- GSMA has deliberately and strategically connected and supported effective collaborations between diverse actors: MNOs, start-ups, government, donors and NGOs (e.g. AI Forest Fires, EW4All, Smart Villages).
- GSMA has played a key role in influencing climate dialogues on anticipatory capacities, such as contributing to EW4All reforms and possibly forest fire policy shifts.

6.1.3 Catalytic funding, technical and relational support

- The Innovation Fund helps start-ups experiment and learn how to combine different elements of technology and services, aiming to achieve optimal pricing and scale regarding target populations (e.g. agri-advice with loans).
- GSMA has strengthened grantee capacity and financial systems (e.g. BKK, Buraq).

6.1.4 Sensitive to issues of gender and inclusion

- GSMA has integrated gender-aware design (e.g. IVR for women, women's training in Smart Villages) and promoted inclusion in technology delivery and design.

6.1.5 Emerging internal coherence

- There is growing synergy between early warning, agriculture and resilience initiatives, and some alignment across humanitarian and development activities that seek to advance resilience in Pakistan.
- GSMA M4D and GSMA Mutual have successfully aligned climate initiatives with GSMA Asia Pacific's broader Digital Nation agenda.

6.2 What GSMA needs to improve

6.2.1 Country strategy and coordination

- GSMA needs an in-country climate strategy supported by a monitoring, evaluation and learning (MEL) system to align and track projects. A country coordinator will be essential to progress this, and enable GSMA to respond to political shifts.
- To maximise learning thus far, the strategy needs to go beyond what GSMA is comfortable addressing and instead be rooted in a broad analysis of factors that shape Pakistan's key climate vulnerabilities. This would enable more deliberate efforts to address gender norms, for example.

6.2.2 Learning and weak internal systems

- Despite recent improvements, insights need to be shared more systematically across projects.
- Learning remains ad hoc and often tied to individual staff. There is a need to embed learning from different teams such as Digital Utilities, Climate Tech and the Central Insights Unit across organisational structures and processes.

6.2.3 Limited impact measurement

- Outcomes on adaptive capacity and long-term resilience are unclear or anecdotal. There is a need for more investment in assessing the sustainability of results reported – for example, on climate-smart agricultural advice that is bundled with financial services (BKK).
- There are no consistent metrics or evidence on how interventions and services impact poor and vulnerable groups at different levels (household, community, etc.). Agricultural interventions do not explore potential impacts on consumers and wider communities, which may be significant.

6.2.4 Challenges with scalability and inclusion

- More focus and effort is needed to address factors that make scaling a challenge. This may include exploring possibilities for strategic partnerships with important non-tech actors in the climate action ecosystem – for example, the Food and Agriculture Organization of the United Nations (FAO).

6.2.5 Organisational constraints

- Rigid Innovation Fund budgets are somewhat limiting, both at the level of individual projects but also more broadly. It would be helpful to give grantees more flexibility and guidance on how to develop budgets that anticipate uncertainty and the need for adaptation.
- Technical assistance is sometimes generic and not tailored to contextual factors and needs.

6.3 Strategic recommendations

6.3.1 Coherent and contextualised country strategy

GSMA should develop a medium-term, integrated country strategy for Pakistan that connects mobile innovation to meaningful climate and environmental outcomes, particularly targeting the most vulnerable groups as potential beneficiaries of its actions. The strategy should be grounded in a clear, localised theory of change informed by climate vulnerability assessments, political economy analysis, learning from successful initiatives such as AI FF as well as EW4All as well as mobile ecosystem dynamics. It could consider some of the models and approaches outlined in the main evaluation reports recommendations (EQ3)

A Pakistan Country Coordinator should be appointed, in-country, supported by a robust planning and MEL system that enables continuous alignment, tracking and adaptation (see Section 6.3.2 below). This system should serve as the backbone for GSMA's engagement – building on accomplishments thus far and ensuring even more strategic coherence across advocacy, brokering, capacity support, research and grant-making.

A context-specific assessment of climate and environment related vulnerabilities, focused on the underlying political, institutional and social causes, might include embedded action research with target communities, security permitting. Ecosystem mapping could complement this by identifying key actors in both the mobile and climate adaptation spaces. Leveraging strategic partnerships developed over the past few years – particularly with donors, MNOs, champions in government as well as current civil society partners, local associations representing vulnerable groups (such as urban informal workers) – is likely to further enhance the relevance and scalability of interventions.

GSMA must also assess the enabling and constraining factors (at the structural, political and individual levels) that influence the adoption and impact of specific technologies. Where possible solutions should be designed through a process of co-creation with users and stakeholders, and supported over longer timescales to enhance sustainability and systems change.

6.3.2 Strengthened monitoring, evaluation and learning

MEL systems should prioritise learning and outcomes, beyond IF and technology uptake. A country-level MEL framework should track and synthesise data across activities and the portfolio, enabling insights into the benefits of strategic partnerships and how they influence who benefits, how, and under what conditions. This might include assessing resilience capacities.

Embedded research could play a critical role in understanding the impacts of initiatives on producers, consumers, and the broader systems they are part of. This should help to highlight any potential unintended consequences. Tools such as outcome harvesting and process monitoring will support evaluation of key initiatives such as EW4All. Insights from this MEL system should feed directly into strategy adaptation, learning, and assessments of the overall innovation model.

Data systems should also enable the tracking of longer-term impacts, including environmental and socioeconomic effects, and (where relevant) contributions to carbon emission reductions linked to market mechanisms.

6.3.3 Systems thinking and long-term evaluation

GSMA should move toward an accompaniment evaluation model that supports long-term system change. This involves integrating internal learning with periodic external reviews, and situating climate tech evaluations within broader political and ecosystem analyses.

Understanding the systems in which innovations operate will help identify barriers and enablers of scale, ranging from policy environments and market structures to social norms and vested interests. This approach supports more adaptive programming, and will put GSMA in a better position to contribute to significant adaptation in Pakistan.

6.3.4 Inclusive and scalable innovation

To ensure accessibility, solutions should be designed for low-literacy users, offline functionality, and under-served areas. Hybrid models that blend digital and in-person delivery (often through trusted local partners) can enhance uptake and usability.

Bundling digital solutions with financial services (e.g. credit, insurance, savings) can increase resilience and improve long-term viability. Special attention should be given to inclusive user design, and sustaining reach among historically excluded groups.

6.3.5 Evidence-informed advocacy

GSMA's ability to convene actors around critical climate challenges (such as early warning systems and forest fire management) should be linked to evidence-based advocacy. This requires building on recent success of co creating, embedded research that documents and shares results in real-time with policy audiences.

Evidence that is co-produced with partners and communities may have a stronger influence on digital and climate policy. It is also more likely to generate external interest and support donor engagement. Clear, well-communicated insights into what works in specific contexts, with specific groups, could boost GSMA's credibility as a strategic actor in climate and digital development.

6.3.6 Value for money and impact pathways

Finally, the Pakistan country strategy must clearly articulate GSMA's value proposition: how GSMA's efforts provide value for money – particularly for funders such as FCDO – by outlining clear assumptions and causal pathways. This includes showing how digital innovation reduces vulnerability, enhances inclusion, and strengthens systems.

By demonstrating how its interventions enable scalable, cost-effective outcomes for vulnerable populations in high-risk environments, GSMA can strengthen the case for sustained investment and cross-sector collaboration.

List of respondents and documents reviewed for Pakistan case study

Name	Title	Organisation	Respondent type	Interaction
Nadeem Ahmed	Policy Manager, Climate Change	FCDO Pakistan	Donor	Key informant interview
Luisa Odell	Innovation and Technology Advisor	FCDO	Donor	Key informant interview
Phil Outram	Tech and innovation adviser	FCDO	Donor	Key informant interview
Sobia Khan	Corporate Communication Expert	Universal Service Fund (USF) Pakistan	Government	Key informant interview
Junaid Yamin	Co-Founder and Chief Executive Officer (CEO)	WeatherWalay	Grantee	Key informant interview
Fozia Hussain	Senior Manager projects and partnerships	BKK Grantee/ WeatherWalay	Grantee	Key informant interview
Humaira Rana	Project Manager	Crop 2x Grantee	Grantee	Key informant interview
Muhammad Asad	Director of Operations	Buraq Integrated Solutions (Pvt) Limited	Grantee	Key informant interview
Samir Hafiz	Climate Monitoring, Evaluation and Learning Manager, London	GSMA	GSMA Staff	Key informant interview, Focus group, Sensemaking session
Bilal Qureshi	Digital Inclusion, Innovation and Impact Investment	GSMA Pakistan	GSMA Staff	Key informant interview
Mirza Muhammad Zohaib	Innovation Fund Manager (APAC)	GSMA Pakistan	GSMA Staff	Key informant interview
Nigham Shahid	Senior Insights Manager, Central Insights Unit	GSMA London	GSMA Staff	Key informant interview
Saira Faisal	Country Lead Digital Transformation, Asia Pacific, Pakistan	GSMA Asia Pacific	GSMA Staff	Key informant interview
George Kibala Bauer	Senior Director, Climate Tech and Digital Utilities	GSMA London	GSMA Staff	Key informant interview, Sense making session
Muhammad Arham Shoukat	Former Market Engagement Manager Pakistan	ex-GSMA Pakistan	GSMA Staff	Key informant interview
Bryce Hartley	Senior Manager, Strategic Partnerships and Market Engagement	GSMA	GSMA Staff	Key informant interview

Taimoor Hassan	Head of Digital Products & Growth	Jazz Pakistan	MNO	Key informant interview
Muneeb Khan	Head of Digital Analytics and Strategy	Jazz Pakistan	MNO	Key informant interview
Salman Iqbal	Manager Usability and Design	Jazz Pakistan	MNO	Key informant interview
Anayat Khan Swati	Field Coordinator	WWF	NGO	Key informant interview
M Waseem Khan	Manager	WWF	NGO	Key informant interview
Muhammad Ibrahim Khan	Director	WWF	NGO	Key informant interview
Babar Sahib Din	CEO	Lahore Waste Management Company (LWMC)	State-owned enterprise (SOE)	Key informant interview
Shoaib Dar	Head of Operations and HOD Control Room	LWMC	SoE	Key informant interview

List of documentation reviewed for Pakistan case study

The evaluation team reviewed large quantities of internal GSMA programme and project documentation as part of this case study. We have listed below all internal and external documentation referred to directly in the case study.

Adam Smith International. COP29, Pakistan's climate crossroads and the urgency for climate finance.
Aurora. (2025) DawnMedia Delivers on its Call for Collective Climate Action - Aurora
Government of Pakistan. Pakistan National Action Plan 2023
GSMA (2024) Realising Pakistan's Aspiration to become a Digital Nation
GSMA CR BKK Baseline Report
GSMA. (2025) Leveraging Digital Technology for Climate-Smart Farming in Pakistan: BKK Mobile for Development
GSMA. Buraq Integrated Solutions Mobile for Development
GSMA. Crop2X Mobile for Development
GSMA. Jazz Pakistan Mobile for Development
GSMA. Outcome Harvest Learning report based
GSMA. Pressure on urban services
GSMA. Smart Village Pakistan Outcome Map
ICNL. (2024) Pakistan Civic Freedom Monitor.
International Growth Centre. (2024) Climate action and political economy in Pakistan
M. Bilal Farooq. (May 2023) Climate-Tech Startups Shaping Pakistan's Future https://propakistani.pk/
Making Digital Pakistan a reality

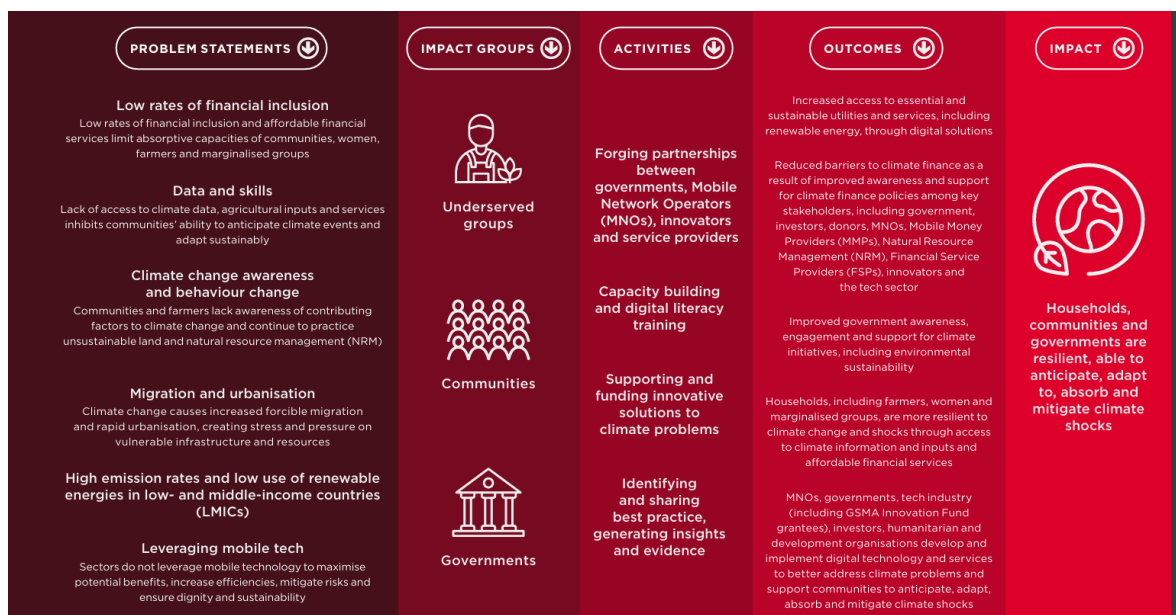
NDMA Pakistan (2025) National Disaster Risk Reduction Strategy 2025 – 2030, Pakistan. National Disaster Management Authority, Islamabad, Pakistan.
Pakistan Ministry of Climate Change (2017) Pakistan: Climate Adaptation Technology Action Plans & Ideas
Pakistan Ministry of Climate Change (2017) The Transformative Role of Information Technology in Pakistan - Stratheia,
Pakistan Ministry of Climate Change (2021) National Climate Change Policy
Pakistan Ministry of Energy. Energy Efficiency & Conservation Strategic Plan 2020-23 by National Energy Efficiency and Conservation Authority NEECA - Climate Change Laws of the World
Radio Pakistan. (2024) Pakistan unveils first National Climate Finance Strategy
Revised Pakistan 2022 Floods Response Plan Final Report (Issued 15 Dec 2023) OCHA
SOAS. (2022) Pakistan: An interesting paradox of growth without development
State Bank of Pakistan. Financial Inclusion: Financial Literacy & Capacity Building
The Nation. (2025) Mobile-powered Early Warning Systems key to disaster preparedness: Jazz CEO
World Bank Group. (2022) Pakistan Country Climate and Development Report. CCDR Series; Washington DC: World Bank. http://hdl.handle.net/10986/38277 World Bank Document,
World Bank. (2023) Turning Concern into Action: Understanding Climate Change Attitudes in Pakistan
Zong. Corporate Social Responsibility - Zong 4G Pakistan

Annexe 8: Terms of reference for a country researcher

Terms of Reference for a country researcher for the **GSMA Mobile for Development Foundation Strengthening Climate Action through Digitalisation: A Formative Evaluation of Contributions and Potential.**

Introduction

GSMA's Mobile for Development Foundation (M4D) has been working alongside donors for over a decade to harness the power of mobile technologies to create innovative pathways for addressing impacts of climate change outlined in the Paris Agreement, albeit until recently somewhat implicitly.³¹⁵ Diverse initiatives have been implemented during two phases of a Strategic Partnership to enhance mobile for development (M4D) between GSMA and the Foreign, Commonwealth & Development Office³¹⁶ (FCDO) and under another FCDO partnership agreement Mobile for Humanitarian Innovation (M4H).³¹⁷ These Mobile for Humanitarian (M4H) and Development (M4D) initiatives, which have more recently been termed 'climate actions', aim to take advantage of rapidly changing technologies to reduce the vulnerability of societies including government, poor communities, households and marginalised people to the effects of climate change. To achieve these aims GSMA supports the testing and scaling of innovative solutions through a suite of activities/interventions outlined in a recently developed climate theory of change or use case below.³¹⁸



The climate actions tested by GSMA thus far have tended to focus on agriculture, energy and early warning responses. They involve partnerships with both private sector actors like MNOs who are assumed to have commercial and social impact incentives. Additionally GSMA M4D works with governments and public sector actors keen to improve utilities and service delivery, particularly in urban areas where impacts of climate change such as floods present huge challenges.

Like the UK Government,³¹⁹ GSMA M4D is keen to make climate and climate finance more central to its development work. GSMA's interest in bringing its diverse areas of climate work together in one framework and assessing its potential to contribute to effective climate action has prompted the

³¹⁵ This 2021 report outlines possible areas [The-Role-of-Digital-and-Mobile-Enabled-Solutions-in-Addressing-Climate-Change-Final..pdf \(gsma.com\)](#)

³¹⁶ [DevTracker Programme GB-1-203804 \(fcdo.gov.uk\)](#)

³¹⁷ [DevTracker Programme GB-GOV-1-300446 Documents \(fcdo.gov.uk\)](#)

³¹⁸ We consider this a programme theory

³¹⁹ [The Kew Lecture: Foreign Secretary's speech on the climate crisis - GOV.UK \(www.gov.uk\)](#)

commissioning of a **theory based, formative learning evaluation**.³²⁰ The aim of this evaluation is to generate and consolidate evidence and insights that will enable M4D to consider opportunities to strengthen strategic coherence across the portfolio and position M4D in a way that will reflect its potential to play a pivotal role on key issues at the nexus of digital solutions and climate resilience. More specifically, it is expected that this work should encompass research and evaluation in an iterative process to understand:

- In what ways digital solutions can expect to contribute to climate action – including mitigation, adaptation and resilience.
- The totality of M4D's climate portfolio, and the extent to which M4D's climate work has contributed to climate action or would have the potential to, in the future, with adaptations to programme design models.

As such, this evaluation aims to deepen understanding on how and why various uses of digital technology can contribute to climate change mitigation, adaptation, resilience, natural resource management and environmental sustainability for impact groups in different contexts (or not). It also aims to answer questions on whether and how digital technology can be leveraged even more strategically and effectively through GSMA's M4D innovation model³²¹ in the future. Addressing these issues will involve contextualising GSMA's role in the wider climate action space. It will require engaging with the implicit value proposition that GSMA is best qualified and placed to support, test, research and support advocacy and learning that increases the use of digital technologies for climate action at scale. There are, however, limitations in the extent to which this evaluation will be able to fully address these questions, as discussed in the inception report which will be available to successful candidates.

TAP Room, the international team who have been contracted for the evaluation is now seeking experienced qualitative researchers with strong understandings of climate change and the role of digital technology in development to undertake qualitative research for an evaluation case study in Kenya/Pakistan.

Overview of the Work

The TAP Room will provide the successful applicant with documented information about the work GSMA M4D has been doing in Kenya/Pakistan, such as the findings from a portfolio mapping which will include details of activities and evidence of outcomes and impact already collected. The successful applicant will then be expected to work with other TAP Room researchers to complete a design for research including the completion of a purposive sampling strategy and plan and data collection tools. Ethics and quality of evidence standards will be discussed.

The research will require the researcher to undertake relevant web based searches and reviews of GSMA M4D documentation and other relevant literature. The research will also involve the conduct of up to 20-30 interviews or focus group discussions including GSMA and stakeholders that have directly engaged with the GSMA M4D Climate programme as well as other resident experts on climate change and technology who might reasonably be expected to be familiar with the work.

³²⁰ We note that formative evaluation is not identified in the FCDO Equals framework and understand it as distinct from developmental evaluation. While developmental evaluation supports adapting and changing an innovation for ongoing development, formative evaluation supports improving a model in preparation for summative evaluation. [Michael Quinn Patton on developmental evaluation as alternative to formative assessment | Better Evaluation](#). In this context we understand the model to be GSMA's approach to digital tech innovation for climate action mostly in the areas of climate change adaptation and resilience

³²¹ The term 'innovation model' is used here to describe all of the work GSMA M4D does to support the scaling of innovative technology for climate action, not only that funded by the innovation fund though this is an important component of the model

Given substantial existing data and evidence on some outcomes, it will be important not to duplicate effort and interview respondents that have already participated in many other GSMA evaluation interviews. Therefore, choosing areas for focus and respondents will need careful consideration and consultation with TAP Room and GSMA M4D.

The consultant will be expected to record and transcribe interviews (using AI where possible), take notes and undertake coding and analysis to inform the write up of the report.

The complete case study using a combination of sources and methods is expected to cover the following questions.

Indicative Kenya/Pakistan Case Study Tentative Research Questions

On Context

These questions are to enable analysis on the relevance and coherence of GSMA's interventions as well as factors that have and will help or hinder M4D's work on climate action. While some points may be covered in GSMA publications such as endline reports, which the researcher should review, the researcher is expected to engage with other sources. This is to provide a point of comparison for the quality of GSMA's analysis in these areas. The TAP Room core team will support country researchers in narrowing the scope of this work and also accessing relevant secondary data from other sources, for example from FCDO, Sida relevant United Nations offices.

The data collected in the context analysis will be used later in the assessment of the relevance and coherence of activities (question 10.6) and in the section on how and why activities have intended outcomes or impacts (or not).

1. What are the key climate change and environmental risks affecting GSMA M4D impact groups in different parts of Kenya/Pakistan? What are the vulnerabilities?? How has evidence on these changed in the last 5 years and why?
2. What is the current state of public and political discourse on climate change and environment, and how, if at all has it changed over the past five years and why? What is the direction of travel in the future?
 - 2.1. Which political, economic, social factors and actors are encouraging debate and making contributions to policy that addresses climate change issues faced by different GSMA impact groups? Why?
 - 2.2. Which political, economic and social factors and actors are blocking such discussions or changes? Why?
3. Which of the current problems identified by GSMA M4D are relevant in the Pakistan context and for who? Which are the three that are the most significant when it comes to reducing vulnerability to climate change?
 - 3.1. Low financial inclusion
 - 3.2. Poor access to relevant data and skills
 - 3.3. Low climate change awareness at community level
 - 3.4. High levels of migration and urbanisation
 - 3.5. High emission rates
 - 3.6. Low leveraging of mobile tech to address climate change problems

4. What is the current state of climate change policy, regulation and finance (with specific reference to carbon markets and payments for ecosystem services) and environmental issues?
 - 4.1. How if at all has it changed over the past five years and why?
 - 4.2. What is the anticipated direction of travel in the future? What opportunities does this bring?

5. Other than GSMA, who are the key actors from the following categories working on climate change issues that are GSMA priorities and what roles do they play:
 - 5.1. Government ministers
 - 5.2. Academics/think tanks
 - 5.3. International Development Partners
 - 5.4. Private sector entities
 - 5.5. Media
 - 5.6. International NGOs
 - 5.7. Kenyan NGOs and community based organisations
 - 5.8. Local NGOs
 - 5.9. Unions, social movements, faith based groups

6. What is the current state of public and political discourse on digital technology in development and or climate change and how has that changed over the past five years and why? What is the direction of travel in the future?
 - 6.1. What political, economic and social factors and actors are encouraging discussion on the use of digital technology in development and for climate change and why?
 - 6.2. What political, economic and social factors and actors are blocking or discouraging discussion and why?

7. What is the state of the legal and regulatory environment in respect to digital solutions?
 - 7.1. How if at all has it changed over the past five years and why?
 - 7.2. What is the direction of travel in the future? Where are the key opportunities?

8. What is the current state of the mobile ecosystem and commercial markets for mobile technology in Kenya/Pakistan?
 - 8.1. How, if at all, has it changed over the past five years and why?
 - 8.2. What is the direction of travel in the future?

9. Other than GSMA, who are the key actors working on digital technology in development and climate change issues, such as renewable energy, urban infrastructure, early warning systems, climate forecasting, climate finance, waste management, the blue economy and natural resource management
 - 9.1. Government ministries
 - 9.2. Academics/think tanks
 - 9.3. International Development Partners
 - 9.4. Private sector entities
 - 9.5. Media
 - 9.6. International NGOs
 - 9.7. Kenyan NGOs and community based organisations

- 9.8. Local NGOs
- 9.9. Social movements, trade unions, faith based organisations

GSMA M4D Climate Action Activities

The following questions aim to explore the range of activities that GSMA M4D has undertaken that intentionally or unintentionally contribute to climate actions and impacts in Kenya/Pakistan over the past five years. These include work led by the Climate Tech, Digital Utilities, Digital Inclusion teams and also relevant work by M4H. You will be given details of most key activities and outcomes when you start work, but you may discover others during initial engagement with GSMA M4D and M4H staff and stakeholders.

(Questions on outcomes and reasons why they were or were not achieved are covered in the next section)

1. What activities implicitly or explicitly related to climate change has GSMA supported in Kenya/Pakistan during the last 5 years in areas of
 - 1.1. Innovation grants:
 - 1.1.1. What GSMA M4D Climate TOC problems did each grant address?
 - 1.1.2. With reference to your contextual analysis, which climate change problem does it address?
 - 1.1.3. What was the baseline situation of the grantee and their motivation for application?
 - 1.1.4. With reference to their road map, which were the key technologies that were central to the innovations?
 - 1.1.5. What was the state of its development and or use in the local market/context?
 - 1.1.6. Who were the main intended users of the technology innovation: government/private sector actors/NGOs/community groups/households/ individuals/ women/ other marginalised groups?
 - 1.1.7. What were they expected to use the technology for and what was its intended impact? What improvements was it anticipated to have over a counterfactual of not using the technology?
 - 1.1.8. What were the assumptions on how and why users would adopt the technology? What are the assumptions around its impact?
 - 1.2. Forging Partnerships:
 - 1.2.1. With reference to the context analysis, who do GSMA consider to be the main stakeholders for partnership/ecosystem strengthening?
 - 1.2.2. Are there relevant actors identified in the context analysis that have not been included in the partnership ecosystem efforts?
 - 1.2.3. What actions have been taken to support the development of relationships between MNOs, other actors in the mobile ecosystem, governments, businesses including grantees and other actors?
 - 1.2.4. What were the aims of the activities?
 - 1.2.5. What are the assumptions regarding why they would work?
 - 1.3. Conducting research, sharing insights and advocacy:

- 1.3.1. What M4D insights and evidence products which are part of the M4D (and M4H) climate portfolio have been:
 - 1.3.1.1. Produced in country
 - 1.3.1.2. Disseminated in country
 - 1.3.1.3. Which, if any of these, include insights from GSMA M4D's innovation grants?
- 1.3.2. What were the aims of dissemination?
 - 1.3.2.1. Whom were they shared with globally and in country?
 - 1.3.2.2. How, if at all, did dissemination link to innovation grants, forging relationships or capacity building?
 - 1.3.2.3. What are the assumptions on why they would achieve their aims?
- 1.4. Capacity building:
 - 1.4.1. What capacity building has been supported by GSMA and how?
 - 1.4.2. What were the aims?
 - 1.4.3. How if at all did capacity building link to work under other activity types?
 - 1.4.4. What were the assumptions on how and why it would work?
 - 1.4.5. Do the above activities involve engagement and or support from FCDO?
- 1.5. Who in the GSMA M4D team engages with FCDO on climate related issues?
 - 1.5.1. Who is their point person?
 - 1.5.2. What has been the nature of engagement for example
 - 1.5.2.1. Has FCDO commissioned research from GSMA?
 - 1.5.2.2. Has FCDO shared research and intelligence?
 - 1.5.2.3. Has FCDO brokered relationships for GSMA M4D or partners visa-versa?
- 1.6. Is GSMA's climate portfolio (undertaken by different teams using different interventions) in Kenya/Pakistan relevant, coherent and aligned with climate change mitigation, adaptation, resilience and sustainable environmental resource management needs and initiatives of actors in the wider ecosystem and sectors **identified in the context section?**

Illustrative rubric to assess relevance that will be further developed in collaboration with GSMA

Standard	Not as relevant as it might be	Quite relevant	Extremely relevant
Criteria	Addresses a problem but it is seen as relatively minor and affects small numbers of people, few of whom are from marginalised groups	Addresses a problem that is widely recognised as affecting specific populations of poor and marginalised	Addresses a serious problem that is widely recognised as affecting large populations of poor and marginalised

Illustrative rubric to assess coherence and alignment that will be further developed in collaboration with GSMA

Standard	Not as coherent and aligned as it might be	Quite coherent and aligned	Extremely coherent and aligned
Criteria	TBC		A

Emerging outcomes and insights into how and why GSMA activities worked to achieve them

2. What evidence is there that activities outlined in the section are leading to the kinds of outcomes anticipated?
 - 2.1. Which activities are contributing to outcomes outlined in the TOC?
 - 2.2. Which are not?
 - 2.3. In instances where activities are not having expected outputs or outcomes, what actions has GSMA taken?

3. How and why are they leading to expected outcomes or not?
 - 3.1. What are the incentives and capacities that are helping or hindering the engagement of different stakeholders with GSMA initiatives and triggering outcomes and impacts or not?
 - 3.2. What are the enabling and disabling conditions related to the mobile ecosystem and other economic, political, regulatory and social contextual factors that help or hinder implementation, incentives, capacities and the achievement of outcomes and impacts for different impact groups?
 - 3.3. How does the GSMA programme context and design enable or disable outcomes? For example:
 - 3.3.1. Are grant sizes, amounts and terms appropriate?
 - 3.3.2. Are there sufficient staff to support the work?
 - 3.3.3. Is the approach to partnership and convening effective?
 - 3.3.4. Is communication and coordination effective?
 - 3.3.5. Is monitoring and evaluation able to satisfy learning and reporting needs?
 - 3.3.6. Etc.

So what: Making conclusions and recommendations

4. What does evidence from the context analysis, activities and evidence on outcomes above as well as key findings from the literature review conducted by the TAP Room suggest about the appropriateness of GSMA M4D's current delivery model/ theory of action for driving technological innovation for climate action and impact at scale in Kenya/Pakistan?
5. What if any are the evidence gaps?
6. What and where are the opportunities for M4D's approach to digital tech innovation, research and collaboration to have more strategic impact on climate action to address climate vulnerability in Kenya?
7. What strategy and implementation and MEL adjustments would be needed to realise this impact?

Annexe 9: Outcome analysis

This is a unedited summary of evidence and sources used for the outcome analysis.

Country	Analysis of initiatives and outcomes
Bangladesh	<p>ATEC – eCook stoves for clean cooking (Innovation Fund Round May 2021, for Digital Urban Services)</p> <p><i>Context:</i> Particulate matter (PM2.5) from dirty cooking methods causes severe health problems, especially for women, with four million deaths annually.³²² In Bangladesh, over 70% of households still use biomass, with low-income families spending significant time collecting fuel and cooking inefficiently.³²³</p> <p>A TEC, initially supported by Engineers Without Borders, identified eCook stoves to improve efficiency, cut emissions, and deliver health and other benefits to women.³²⁴ Carbon credits were seen as providing a sustainable revenue model—if customers could be trained and incentivised to adopt eCook stoves.³²⁵</p> <p><i>GSMA support:</i> The GSMA Innovation Fund enabled ATEC to develop an IoT-enabled eCook ecosystem. An Android app, integrated with the devices, tracks electricity use and carbon offsets, enables payments, and offers customer support.³²⁶ IoT-connected SIMs feed data to servers that automatically mint Gold Standard carbon credits, reducing over-crediting risks.³²⁷ ATEC struck a deal with a company ENGIE to buy credits which was an innovative in using digital MRV data.³²⁸</p> <p>Launched during COVID, the eCook stove app’s remote onboarding guided buyers through purchase and use.³²⁹ Carbon credit revenue subsidised stove costs and rewarded higher cooking activity.³³⁰</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • Business capabilities: ATEC, already a mature business, developed a transparent and innovative approach to link different actors in carbon credit chains.³³¹ • Partnerships: Stronger relationships with MNOs that enabled connections with cooks and purchasers of carbon credits. Although ATEC already had relationships with MNOs and carbon credit purchasers, a grantee relationship with GSMA increased ATEC’s legitimacy and supported its ability to attract investment of over \$2.86m during the grant period.³³² ATEC <ul style="list-style-type: none"> ○ signed a long-term multi-country agreement with ENGIE’y for the purchase of up to 11.5 million tons of digitised carbon credits.³³³ ○ partnered with DANIDA to scale up electric cooking in Bangladesh³³⁴ ○ partnered with Biniyog Briddhi and Roots of Impact to finance its impact measurement practices.³³⁵ • Government awareness and engagement: NA • Reduced barriers to climate finance: ATEC developed technology that enables reliable and transparent real time monitoring of carbon reductions

³²² [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³²³ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³²⁴ KII Grantee

³²⁵ KII Grantee

³²⁶ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³²⁷ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#), KII Grantee

³²⁸ KII Grantee

³²⁹ KII Grantee

³³⁰ KII Grantee

³³¹ KII Grantee r, GSMA M4D Donor reporting

³³² GSMA M4D Donor reporting, KII Grantee

³³³ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³³⁴ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³³⁵ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

	<p>due to eCook stoves as well as associated carbon credit trades between cooks in Bangladesh and Corporations in Europe.³³⁶</p> <ul style="list-style-type: none"> • <u>Access to services and utilities</u>: pay-as-you-go eCook stove helped over 4,400 users switch to cleaner cooking methods, cutting 1,700 tonnes of carbon emissions.³³⁷ • <u>Individual, community or household resilience</u>: 73% users reported being satisfied and saving cooking time of 1 hour a day. This reduced household costs and improved the quality of life of mainly women users.³³⁸ <p><i>Factors that helped progress</i></p> <ul style="list-style-type: none"> • Commercial viability: <ul style="list-style-type: none"> ◦ Digital payments, and PAYG helped users and business manage finance³³⁹ • Utility: Safety and ease of use of the stove.³⁴⁰ • Good quality online support • Bundled services integrated payment gateways, QR codes for shared use with separate payments.³⁴¹ • Cook-to-Earn incentives encouraged behaviour change.³⁴² • Gender-sensitive outreach addressed male ownership of stoves.³⁴³ • Supportive MNOs (particularly in Bangladesh), and enabling government agreements.³⁴⁴ • Specialist consultant enabled accurate carbon credit calculations for buyers³⁴⁵. • Patient corporate partners, high integrity, and transparency.³⁴⁶ • GSMA's support for financial management – de risking for investment.³⁴⁷ <p><i>Factors that hindered progress</i></p> <ul style="list-style-type: none"> • Full transition to clean cooking was difficult—users still relied on multiple methods, some polluting.³⁴⁸ <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • good on the technology, multiple sources and evidence cited by GSMA demonstrate the technology works. • Weaker on precise contribution of GSMA's innovation approach – single interview: Though ATEC could have developed relationships with other investors and MNOs needed to make SIMs work with IOT, GSMA's endorsement made this much easier.³⁴⁹
Egypt	BENAA - Developing Smart Decentralised Sanitation Solutions in Egypt (2022 Innovation Fund for Climate Resilience and Adaptation)³⁵⁰

³³⁶ KII ATEC, [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³³⁷ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³³⁸ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³³⁹ KII Grantee

³⁴⁰ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³⁴¹ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³⁴² KII Grantee, [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³⁴³ KII Grantee, [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³⁴⁴ KII Grantee

³⁴⁵ KII Grantee

³⁴⁶ KII Grantee

³⁴⁷ KII Grantee

³⁴⁸ [Electrifying clean cooking – ATEC eCook stoves in Bangladesh | Mobile for Development](#)

³⁴⁹ GSMA M4D Donor reporting, KII Grantee

³⁵⁰ All of the evidence reported here comes from the GSMA case study that we were advised was the most reliable synthesis of evidence collected from the partner by GSMA and organisations contracted to support MEL gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2024/10/BENAA-Developing-Smart-Decentralised-SanitationSolutions-in-Egypt-Nepal_2024.pdf

Context: Reduced rainfall from climate change is worsening food security and health challenges in Egypt, particularly affecting access to safe water for citizens and dryland farmers. Since 2017, BENNA has worked with communities to promote sustainable and inclusive development. A central focus has been installing solar-powered, decentralised wastewater treatment units that convert wastewater into safe irrigation water—helping address regulatory and logistical barriers that have hampered small-scale decentralised systems under Egypt’s centralised governance framework.

GSMA support: BENNA launched a Digital Water and Sanitation Solution (DWSS) to enhance the operation, maintenance, and usability of its decentralised units. The project integrated an Internet of Things (IoT) monitoring system into treatment units, enabling real-time analysis of treated wastewater quality and nutrient concentrations. This allowed the operations team to respond rapidly to any deterioration in water quality, reducing risks to public health and improving crop safety.

The mobile app, also provided information and advice on the nutrient content of irrigation water, enabling more efficient fertiliser use and potentially lowering costs. The DWSS demonstrated how a smart, solar-powered decentralised treatment system can recycle wastewater for agriculture while reducing contamination in fields. Although the system successfully improved water quality, most farmers were unaware of the changes, highlighting a communication and engagement gap.

Outcomes to which GSMA may have contributed:

- Business capabilities: increase in revenue but commercial sustainability remains a challenge- BENAA’s transition to mobile money to collect subscription payments, led to a decrease in default rates which along with increased investment helped. However the still needed strategic partnerships and pricing models at the end of the grant
- Partnerships: collaboration with Paymob, a mobile money player in Egypt, enabling users to pay for its digital solution via a mobile money platform. It secured an additional \$505,000 during the grant.
- Government awareness and engagement: engaged national and local authorities to secure permission to implement community level water decontamination. Their project was aligned with the national plans for decentralising water management but issues relating to land ownership had to be negotiated locally
- Reduced barriers to climate finance: NA
- Access to services and utilities for natural resource management and environment: Increased community access to more and better quality water for irrigation. 50,408,093 litres of wastewater were treated and reused for irrigation during grant, benefitting land.
- Individual, community or household resilience: 21,180 people benefiting potential health benefits, 2,000 farmers signed up for agricultural advice that could improve adaptive capacity and there were reports of lower costs for septic tanks and user satisfaction with services that relied on clean energy and may reduce risk of flooding

Factors that helped progress

- Strong partnerships and engagement with community helped to overcome complex land ownership arrangements
- Strong relationships with government and alignment with national plans
- BENNA being trusted by community members

Factors that hindered progress

- Solution led: community did not understand potential benefits relating to resilience
- Foreign exchange fluctuations made it difficult to establish viable finance model

	<ul style="list-style-type: none"> • Local talent for scaling scarce as those with skills tend to leave the country • Low literacy and smart phone limit efficiency of SMART phone advisory advice <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • despite being single source, evidence on the technology improving water quality is considered good, as is evidence on challenges. Evidence on technology and innovation model contributing to resilience and NRM weaker. • GSMA's contributions include MNO connections and business advice.
Ethiopia	<p>Lersha Digitising Agriculture and Unlocking Finance in Ethiopia (2022 Innovation Fund for Climate Resilience and Adaptation)</p> <p><i>Context:</i> In Ethiopia, agriculture is highly vulnerable to climate change, which intensifies constraints faced by smallholder farmers—who produce 95% of the country's output—including limited resources and worsening soil degradation. Lersha supports farmers' resilience through integrated services: weather and climate advisories, recommended farm inputs, mechanisation to optimise planting windows, market price forecasts, and access to financial services.</p> <p><i>GSMA support:</i> Lersha enhanced and scaled its platform to deliver more tailored services, increase involvement from service providers, and provide regular agri-climate advice. A key focus was developing technology to expand access to agricultural finance and climate-risk insurance. Lersha onboarded 1,000 rural agents—digitally skilled agriculture graduates—to promote awareness and provide financial education. This enabled farmers to access a holistic mix of online and offline services, including climate-smart agriculture advice, timely weather information, inputs and mechanisation services, market linkages, and financial products.</p> <p>To strengthen these offerings, Lersha built partnerships with three banks, two insurance companies, local mobile network operators (MNOs), NGOs, CGIAR centres, fintech companies, and universities. This ecosystem approach aimed to integrate credit and insurance into the agricultural cycle, enabling more significant climate adaptation.</p> <p>Survey data suggested strong uptake among users, who typically had slightly larger farms and higher incomes than the national average. Most had implemented advice received via Lersha, and over half reported higher yields and incomes. However, some farmers cited financial constraints and lack of equipment as barriers to fully applying recommendations.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • Business capabilities: relationships supported by GSMA helped to expand client base and possibly secure further investments- \$550,000 during the grant period • Partnerships: with Ethio Telecom and Safaricom improved Lersha's reach and ability to address financial inclusion by integrating mobile money services, enabling automatic farmer wallet registration, and embedding credit and insurance products into M-PESA. These collaborations streamlined access, reduced duplication, and expanded digital financial services for smallholder farmers.³⁵¹ • Government awareness and engagement: Lersha engaged government in plans to scale and increase the reach of its climate related agricultural advice and financial services. This involved training government to respond to climate shocks and enlisting government in efforts to legitimise credit products that go against religious norms

³⁵¹ Almost all off the evidence reported here comes from the GSMA case study that we were advised was the most reliable synthesis of evidence collected from the partner by GSMA and organisations contracted to support MEL https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/gsma_resources/digitising-agriculture-and-unlocking-finance-in-ethiopia-lersha/

	<ul style="list-style-type: none"> • Reduced barriers to climate finance: NA • Access to services and utilities: Improved access to financial services and information • Individual, community or household resilience: Increase in farmers accessing climate advice services and 19,000 more enrolled in insurance. Over 90% of surveyed, many of whom re women say they value agricultural advice and act on it* farmers accessing Lersha’s climate information, report increases in anticipatory and adaptive capacities relating to acting on agricultural advice and access to new insurance service. However, indication that some users still face resource constraints that prevent adaptive action on advice illustrating the possible limits to impact on climate related vulnerabilities <p><i>Factors that helped progress:</i></p> <ul style="list-style-type: none"> • Partnerships enhanced credibility and offers: collaboration with three banks, two insurance companies, two MNOs, NGOs, research institutes, and 14 public universities helped to grow customer base. • Designing support services aligned with needs of low literate populations: Lersha’s focus on call centre and off line agent support responded to needs assessments • Playing a de risking role: mobile tech solutions enabled financial institutions to collect farmers; personal data and conduct risk /credit assessments <p><i>Factors that hindered progress:</i></p> <ul style="list-style-type: none"> • Religious beliefs on interest payments meant make some credit products needed for adaptation were unattractive though insurance less so. Support from government helped to overcome these and build confidence in market • Foreign exchange fluctuations made it difficult to establish viable finance mode <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • despite being single source, good on the potential of raising awareness of farming practices and potential (but also limits associated with MNO and bank relationships to bundle financial services to help adapt and act on them). Impacts on resilience less concrete at this stage. No information on possible resilience impacts of improved agricultural practices to community food security and resilience of particularly vulnerable populations • Given Lersha’s strong relationships with other actors, e.g. Mercycorps Agrifin during the GSMA grant period,³⁵² it is difficult to isolate GSMA’s precise contribution to progress made. However, given the formative nature of the evaluation this is less important than acknowledging that the diversity of relationships and contributions increased potential for success.
India	<p>Recircle – transforming dry waste into a valuable resource within a circular economy. (Innovation Fund May 2021, for Digital Urban Services) ³⁵³</p> <p><i>Context:</i> In India, low-value and hard to recycle plastics were typically dumped in landfill. Extended Producer Responsibility (ERP) rules for plastics were introduced by Government in 2016 to address this. Recircle built a digital platform that aggregated the collection and processing of plastic waste in support. It partnered with local waste collectors to collect, sort and pre-process recovered materials, after which the material was channelled to authorised recyclers/processors The business operated their own collection, sorting, and material recovery facilities in Mumbai, and have partnerships covering over 270 waste recovery sites across India.</p> <p><i>GSMA support:</i> During the GSMA grant Recircle expanded this and took advantage of a 2022 change in legislation. Along with a ban on some single-use plastics, companies</p>

³⁵² [Fueling Growth and Resilience: How Mercy Corps AgriFin and Lersha are Driving Innovation, Impact, and Investment in Digital Agriculture – Mercycorps Agrifin](#)

³⁵³ All of the evidence cited in this example comes from a GSMA blog: [Building a national circular supply chain platform – ReCircle’s ClimaOne platform in India | Mobile for Development](#)

were required to register digitally via the [Central Pollution Control Board's online portal](#) before importing or manufacturing plastics to sell EPR credits to businesses. ReCircle's tech-enabled platform, ClimaOne, provided a unified, transparent platform for real-time tracking, backed by data analytics, simplifying reporting and compliance. This enabled a broader role in the ecosystem. Launched in June 2023, it scaled rapidly with the revenue targets set in the grant exceeded by x50. It onboarded 32 clients including major brands such as Hindustan Unilever, Dabur, Hindustan Coca-Cola Beverages, and Nestlé.

Outcomes to which GSMA may have contributed

- **Business capabilities:** Grant enabled Recircle to scale and adapt to take advantage of new legislation as well as build more partnerships and investment.
- **Partnerships:**
 - Recircle worked with a broader range of actors and attracted additional revenue of £600,000 over the course of the IF grant and subsequent partnerships (above).
 - No MNO role identified
- **Government awareness and engagement:** Solution responded to existing government awareness and legislation on the problem. However, this was appreciated. In 2022 Recircle achieved recognition as one of the Top 30 Start-ups by the Ministry of Housing and Urban Affairs (MoHUA) at the Swachhata Startup Challenge.
- **Reduced barriers to climate finance:** RECIRCLE is strengthening the broader EPR ecosystem, supporting other companies to use its solution to monitor and comply with EPR regulations³⁵⁴. This has broader implications for mobilising and tracing carbon credits and climate finance
- **Access to services and utilities:** Waste collection improved in 2022-2023, ReCircle diverted 78,498 metric tons of waste from landfills and turned it into a resource. Moreover, Recircle's ClimaOne platform provides a service that allows businesses to track collected plastic and purchase credits to meet extended producer packaging responsibility (EPR) requirements.
- **Individual, community or household resilience:** Impacts on waste pickers: doubling incomes of over 3,000 informal waste workers (Safai Saathis), with 80% reporting an improved quality of life. This is likely to enhance the absorptive capacity of a poor demographic vulnerable to climate change impacts

Factors that helped progress

- Supportive climate/pollution ecosystem, meant policy and regulatory changes (CPCB's credit-based EPR model) increased the relevance and value of the solution
 - ReCircle's decision to be a tech enabler for others. ReCircle planned a B2B2C offering to consumer brands and platforms.
- Strong client acquisition for scaling, including major FMCG brands.
- Revenue-sharing with waste pickers fostering engagement and sustainability

Factors that hindered progress:

- Initial fragmented compliance landscape pre-2022.

Quality of evidence on technology working and GSMA contributions to outcomes:

- despite being single source, evidence on the success of the application and effects on recycling and improving worker resilience appear plausible.
- It is difficult to isolate GSMA's precise contribution to relationships and progress made from information provided. However, given the formative nature of the evaluation this is less important than acknowledging the regulatory conditions and incentives that enabled the app to take off and

³⁵⁴ [Building a national circular supply chain platform – ReCircle's ClimaOne platform in India | Mobile for Development](#)

	<p>support behaviour change while also evidencing the potential role of technology in transparency and tracking compliance which is relevant for carbon markets and climate finance</p>
India	<p>SMART meters - Digital Urban Utility (Forum Meeting 2024)³⁵⁵</p> <p><i>Context:</i> SMART meters offer huge potential to increase the efficiency of services including those that offer energy efficiency improvements. The Revamped Distribution Sector Scheme (RDSS), introduced by the Government of India in 2021, represents one of the world’s most ambitious initiatives, aiming to replace 250 million conventional meters by 2026. While India has made some progress in implementation, the country has only deployed 16 million smart meters (about 7% of the target), and implementation challenges remain particularly around convening and collaboration among important stakeholders.</p> <p><i>GSMA support:</i> in partnership with the Climate Collective GSMA hosted the Digital Urban Utility Forum (DUUF) to discuss challenges and opportunities in scaling smart metering. The DUUF brought together key stakeholders, including mobile operators, policymakers, meter manufacturers, DISCOMs, and smart grid start-ups, to discuss the path forward with opportunities for MNO collaboration with public companies receiving considerable attention.</p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i> Not relevant as no significant outcomes claimed.</p>
Indonesia	<p>Renewable energy Rooftop Solar Bali (GIZ supported Mobile Innovation Hub)³⁵⁶</p> <p><i>Context:</i> Indonesia aimed to achieve 23 percent share of renewable energy in the national energy mix by 2025. Including through developing rooftop photovoltaic (PV) mobile tech supported systems. A study supported by GIZ and GSMA identified three main barriers to such initiatives. First, technological barriers due to limited digital infrastructure and access to mobile devices, particularly in rural and eastern regions . Second, behavioural barriers, notably low digital literacy affecting more than 40% of the population. Finally, political barriers, from policies and regulation to resource allocation, have also had an impact on the adoption of mobile technology solutions.</p> <p><i>GSMA support:</i> To address these issues and promote the use of rooftop PV systems, GSMA facilitated discussions among key government actors at the national level. It then implemented a pilot project SEERI (Solar Energy Estimator for Rooftop in Indonesia) was initiated through a collaboration between the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), GSMA, and Bappenas, the key partner of the Digital Transformation Center Indonesia in Bali. SEERI aimed combine satellite imagery and Artificial Intelligence (AI) to automatically identify roof span detection. It evaluates the potential for photovoltaic solar systems on rooftops in specific areas. The Bali Province has been chosen as the pilot region for SEERI’s implementation, with full support from the Bali Provincial Government and the Center for Community-based Renewable Energy (CORE) LPPM Udayana University.</p> <p><i>Outcomes to which GSMA may have contributed :</i> no information</p> <p><i>Factors that helped progress</i></p> <ul style="list-style-type: none"> • No information <p><i>Factors that hindered</i></p> <ul style="list-style-type: none"> • No information

³⁵⁵ All of the evidence for this initiative comes from a GSMA blog: [IoT Solutions for Smart Cities: Highlights from the Digital Urban Utility Forum on smart metering in Delhi | Mobile for Development](#)

³⁵⁶ GSMA MIH Climate Tech Report on project 2.1 page 7

	<p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i> Not relevant no significant outcomes claimed important evidence on the limitations and perhaps poor VFM of short term project interventions and evidence that findings from a study on barriers to mobile tech in climate action did not seem to inform project designs – they seemed to loose their focus on climate outcomes</p>
Indonesia	<p>Renewable energy – innovation competition to support start ups (GIZ supported Mobile Innovation Hub)³⁵⁷</p> <p><i>Context:</i> A study supported by GIZ and GSMA identified three main barriers to such initiatives. First, technological barriers due to limited digital infrastructure and access to mobile devices, particularly in rural and eastern regions . Second, behavioural barriers, notably low digital literacy affecting more than 40% of the population. Finally, political barriers, from policies and regulation to resource allocation, have also had an impact on the adoption of mobile technology solutions</p> <p><i>GSMA support:</i> launched an incubation programme for 10 early-stage renewable energy start-ups, backed by a diverse group of partners that included community organisations, Xendit, MakeWebEasy, Indosat Ooredoo Hutchison (IOH) and CASE. This aimed to address low digital literacy and foster connections</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> 2 businesses reported to be using knowledge to expand customer base • <u>Partnerships:</u> New collaborations between startups Telkom and KKP • <u>Government awareness and engagement:</u> NA • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> NA • <u>Individual, community or household resilience:</u> NA <p><i>Factors that helped:</i></p> <ul style="list-style-type: none"> • NA no significant outcomes beyond macro level support from relevant departments identified <p><i>Factors that hindered</i></p> <ul style="list-style-type: none"> • The project was too short and could only support limited efforts to address challenges identified in a promising initial study on barriers to the uptake of mobile tech <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i> Not relevant no significant outcomes claimed important evidence on the limitations and perhaps poor VFM of short term project interventions. VFM of short term project interventions and evidence that findings from a study on barriers to mobile tech in climate action did not seem to inform project designs – they seemed to lose their focus on climate outcomes</p>
Indonesia	<p>Climate literacy (GIZ supported Mobile Innovation Hub)</p> <p><i>Context:</i> A study supported by GIZ and GSMA identified low digital literacy as a key barrier to behaviour change and the uptake of mobile tech for climate related initiatives.³⁵⁸</p> <p><i>GSMA Support:</i> In collaboration with BAKTI Kominfo, GSMA MIH initiated a project on Natuna Island, in efforts to address low levels of digital literacy, highlighting behavioural barriers. To bridge this divide, it conducted tailored workshops,</p>

³⁵⁷ All from GSMA MIH Climate Tech Report on project 2.2

³⁵⁸ GSMA MIH Climate Tech Report on project 2.3

	<p>empowering a Local Champions Group and a Female Group, which included fishermen’s wives, with digital skills and knowledge of climate change.³⁵⁹</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities</u>: NA • <u>Partnerships</u>: A Memorandum of Understanding (MoU) established a partnership with BAKTI Kominfo as a project partner, to facilitate collaboration between local governments and communities in the Natuna Islands and provided basic digital literacy training to the communities. • <u>Government awareness and engagement</u>: • <u>Reduced barriers to climate finance</u>: NA • <u>Access to services and utilities</u>: NA • <u>Individual, community or household resilience</u>:NA limited increase in awareness after workshops, women’s groups performed poorly <p><i>Factors that helped:</i></p> <ul style="list-style-type: none"> • NA no significant outcomes identified <p><i>Factors that hindered</i></p> <ul style="list-style-type: none"> • The project was too short and could only support limited efforts to address challenges identified in a promising initial study on barriers to the uptake of mobile tech <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • An independent evaluation supports claims made by MIH and suggests that this was an impactful intervention in terms of raising awareness of climate change.³⁶⁰ • GSMA contribution unclear
Indonesia	<p>Waste Management – (GIZ supported Mobile Innovation Hub)</p> <p><i>Context:</i> Lack of government access to data on waste issues contributes to poor waste management in Indonesia and technological, behavioural and political barriers to digital tech prevent the adoption of mobile technology solutions to address this.</p> <p><i>GSMA support:</i> To assist the city of Denpasar GSMA MIH conducted a comprehensive waste landscaping study. This formulated guidelines and recommendations for more efficient, digital technology-based systems. Activities and engagements with relevant stakeholders followed and were well received by both the Denpasar City Government (DLHK) and BAPPENAS, the Ministry of National Development Planning, which recognised the importance of the study for supporting the development of regional waste regulations and aligning with Indonesia’s National Medium Term Development Plan, Regional Medium-Term Development Plan and local regulations.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities</u>: NA • <u>Partnerships</u>: discussions among different actors who would need to collaborate to advance possible solutions. • <u>Government awareness and engagement</u>: some increased government awareness and ideas reported as well as less scepticism on the possible roles of technology by older officers • <u>Reduced barriers to climate finance</u>: NA • <u>Access to services and utilities</u>: study and discussions were well received but no evidence of concrete take-up

³⁵⁹ GSMA MIH Climate Tech Report on project 2.3

³⁶⁰ [Mobile technology-powered projects make significant strides in raising awareness on climate change among Indonesian communities](#)

	<ul style="list-style-type: none"> • <u>Individual, community or household resilience</u>: NA <p><i>Factors that helped:</i></p> <ul style="list-style-type: none"> • Nature of the waste management study – possibly a sense of ownership engaged government interest <p><i>Factors that hindered:</i></p> <ul style="list-style-type: none"> • The project was too short. Although it arguably started to grapple with some of the barriers identified in a promising baseline study on – need for political support and behaviour change, it did not go far enough, for example in considering how to address financial constraints facing government. <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • Some increase in awareness³⁶¹ but important evidence on the limitations and perhaps poor VFM of short term project interventions. • GSMA contribution to discussions on potential of tech³⁶²
Indonesia	<p>Participatory mapping (GIZ Mobile Innovation Hub)³⁶³</p> <p><i>Context:</i> Destruction of mangroves is a key concern of the North Kalimantan government and a particular problem in Setabu due to seaweed cultivation, where enforcement of existing regulations is weak.</p> <p><i>GSMA support:</i> GSMA MIH, GIZ and Indosat Ooredoo Hutchison (IOH) collaborated on a digital participatory mapping project to assist the communities in mapping their marine and coastal areas and improve decision making. Workshops educated communities on climate and environmental issues as well as the potential of digital tools. They then produced a digital map, accessible to all villagers, offer insights into seaweed areas, artificial rivers, mangrove zones and more. These should empowers informed decisions about seaweed cultivation and mangrove conservation. Finally, the digital map was to play a pivotal role in the creation of a semi-formal local regulation (Surat Edaran/SE), such as guidelines for seaweed foundation installation and the appointment of local coordinators from within the community to oversee seaweed cultivation. As a result of the project, mangrove cutting decreased significantly within just a month and the community record ations of efforts to challenge perpetrators</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities</u>: NA • <u>Partnerships</u>: IOH (project partner) improved connectivity around Setabu Village to ensure seamless digital participatory mapping, • <u>Government awareness and engagement</u>: the Setabu village government, as an ecosystem partner, was keen enough to assemble the community to jointly conduct the project. • <u>Reduced barriers to climate finance</u>: NA • <u>Access to services and utilities</u>: NA • <u>Individual, community or household resilience</u>: The village government adopted the map and improved the ecosystem of NRMG. This plus regulatory guidelines for installing seaweed foundations and the appointment of community-based coordinators to oversee seaweed cultivation was said to contribute to a reduction in mangrove destruction that has possible implications for community resilience. <p><i>Factors that helped:</i></p>

³⁶¹ [Mobile technology-powered projects make significant strides in raising awareness on climate change among Indonesian communities](#)

³⁶² GSMA MIH Climate Tech Report on project 3.1

³⁶³ GSMA MIH Climate Tech Report on project 4.1 pages 36-42

	<ul style="list-style-type: none"> Engaged research and mapping with mobile tech involving Sebatu contributed to community action to protect mangroves³⁶⁴. GIZ's operational presence in the area helped broker relationships <p><i>Factors that hindered:</i></p> <ul style="list-style-type: none"> The project was too short and could only support limited efforts to address challenges identified in a promising initial study, nonetheless this example suggests that a modest project involving MNOs and infrastructure improvements can advance change <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> An independent evaluation supports claims made by MIH and suggests that this was an impactful intervention in terms of raising awareness of climate change.³⁶⁵ Plausible evidence of GSMA contribution through involving IOH³⁶⁶
Indonesia	<p>Initiative: Shrimp farming IOT sensors (GIZ supported MIH)</p> <p><i>Context:</i> clearing of mangroves to support large shrimp farms was creating unfavourable environmental conditions for productive shrimp farming I North Kalimantan.</p> <p><i>GSMA support:</i> In collaboration with GIZ and IOH, MIH Indonesia initiated a project on promoting digital and eco-friendly shrimp farming that was aimed to incentivise shrimp farmers to reduce their widespread mangrove deforestation practices.³⁶⁷</p> <p>While the IoT system worked in enabling the monitoring of water quality with the potential to enhance a shrimp farmer's decision-making capabilities and was supported by Borneo Tarakan University it was more expensive than other solutions and made overly simplistic assumptions that new practices would lead to behaviour change and prevent mangrove destruction.³⁶⁸</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> <u>Business capabilities:</u> NA the solution did not meet fishers needs³⁶⁹ <u>Partnerships:</u> Indosat Ooredoo Hutchison, IOH, an Indonesian MNO, was an enthusiastic partner in the GIZ funded climate tech project.³⁷⁰ At the end of GIZ financing they decided to absorb a shrimp farming project into their corporate social responsibility portfolio, though the technological solution did not address the core problem.³⁷¹ <u>Government awareness and engagement:</u> NA <u>Reduced barriers to climate finance:</u> NA <u>Access to services and utilities:</u> NA <u>Individual, community or household resilience:</u> Unlikely – final evaluation and environmental assessment conducted by GSMA suggested that there were cheaper simpler solutions to improve productivity of fish farms. Moreover assumptions in the TOC relating to improved productivity reducing mangrove destruction was questioned.³⁷² <p><i>Factors that helped:</i></p>

³⁶⁴ [Mobile technology-powered projects make significant strides in raising awareness on climate change among Indonesian communities](#)

³⁶⁵ [Mobile technology-powered projects make significant strides in raising awareness on climate change among Indonesian communities](#)

³⁶⁶ KII GSMA Staff

³⁶⁷ GSMA MIH Climate Tech Report on project 4.2 pages 43

³⁶⁸ KII GSMA Staff reflecting on impact/environmental assessment

³⁶⁹ KII GSMA Staff

³⁷⁰ KII GSMA Staff

³⁷¹ KII GSMA Staff

³⁷² KII GSMA Staff

	<ul style="list-style-type: none"> • MNO CSR agenda and interest of staff leading this to support the project³⁷³ <p><i>Factors that hindered:</i></p> <ul style="list-style-type: none"> • Weak problem analysis and feasibility studies • The project was too short and could only support limited efforts to address challenges identified in a promising initial study, nonetheless this example suggests that a modest project involving MNOs and infrastructure improvements can advance change <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • Not relevant no significant outcomes claimed and the reflections by GSMA staff are 'good enough' to be useful and identify factors that prevented significant progress. • Plausible evidence of GSMA contribution through involving IOH³⁷⁴
Kenya	<p>Aquarech - Improving fish farmers' resilience (2022 Innovation Fund for Climate Resilience and Adaptation)</p> <p><i>Context:</i> Fish farming is becoming increasingly important adaptation strategy for farmers moving away from agriculture,³⁷⁵ however fluctuating water temperature also due to climate change pose challenges for poor fishers.³⁷⁶</p> <p>Aquarech, a Kenyan aquaculture company, aims to improve fish farmers' productivity, market access, and resilience to these challenges through mobile technology and IoT sensors.³⁷⁷ Aquarech's services include a farmer app for buying fish feed, receiving advice, selling fish, along with IoT sensors that enable them to monitor water temperature and guide feeding. Aquarech also provides training, building trust and supporting farmers new to aquaculture.</p> <p><i>GSMA support:</i> With an 18-month GSMA grant (from late 2022), Aquarech expanded various features required for the application to be effective whilst also making adaptations such as adding USSD to make it more accessible for non-smartphone users. At the end of the grant Aquarech had developed a fish deli app and increased income from feed as well as scaling IoT sensor users from 10 to 50 farmers using Sigfox technology, and opened five outlets in Kenya. In March 2023, they relaunched their farmer app with improved usability and USSD access.³⁷⁸</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities</u> Increased users of platform from 250 to 3,859, including 1,326 women plus increased investment³⁷⁹ • <u>Partnerships</u> particularly with MNOs: unsuccessful at engaging Safaricom as Aquaculture not one of their ESR priority areas however during the grant Aquarech secured \$1.9M equity plus \$800K in grants were secured.³⁸⁰ • <u>Government awareness and engagement:</u> found it difficult to engage government • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> NA • <u>Individual, community or household resilience:</u> the service has been well-received, by a small number (50) of relatively low income individual fishers. Farmers' anticipatory capacity was reported to have improved via training and early-warning functions; adaptive capacity through precision feeding

³⁷³ KII GSMA Staff

³⁷⁴ KII GSMA Staff

³⁷⁵ [GSMA Innovation Fund for Climate Resilience and Adaptation: Meet the founders | Mobile for Development](#)

³⁷⁶ [GSMA Innovation Fund for Climate Resilience and Adaptation: Meet the founders | Mobile for Development](#)

³⁷⁷ [GSMA Innovation Fund for Climate Resilience and Adaptation: Meet the founders | Mobile for Development](#)

³⁷⁸ Final grant report

³⁷⁹ KII Grantee, final grant report

³⁸⁰ KII Grantee, final grant report

	<p>and market access; absorptive capacity through better stocking practices, though gaps remain in financial products for climate loss recovery. Aquarech plans to add credit features to enhance resilience further.³⁸¹.</p> <p><i>Factors helping progress</i></p> <ul style="list-style-type: none"> • GSMA funding enabling tech upgrades and outreach expansion • Farmer trust built through training and support • Strong market demand for climate-resilient aquaculture solutions • Investment attraction from global aquaculture funds <p><i>Factors hindering progress</i>³⁸²</p> <ul style="list-style-type: none"> • Procurement and technical failures of IoT sensors • Bureaucratic delays in outlet setup • Lack of mobile network operator partnerships (MNO focus misalignment) • Current sensors' limited data range (no oxygen level monitoring) <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i> we note that the Aquarech case study was never completed after our submission of an initial draft and are aware that there was some fabrication during the environmental assessment³⁸³. Therefore we have little confidence in claims of outcomes or insights on factors that helped or hindered progress.</p>
Kenya	<p>Climate finance and carbon credit platforms: 4RD relationship with Safaricom (Service contract)³⁸⁴</p> <p><i>Context:</i> 4RDigital (4RD) has long had an interest in supporting the development of platforms to enable communities greater access to climate finance. This builds on previous successes in developing and promoting mobile money solutions including through relationships with Safari come in Kenya.</p> <p>Safaricom already had a strong reforestation program with the Kenya Forest Service and CFAs. 4RD, with its links to Safaricom, M-Pesa, and GSMA, saw an opportunity to improve carbon credit tracking using remote sensing and digital tools. Although Safaricom wasn't originally targeting carbon markets, 4RD proposed using CAVEX to unlock new value from these projects.</p> <p><i>GSMA support:</i> 4RD, Safaricom, and the Kenyan Ministry of Forestry began developing CAVEX to enable Safaricom to buy carbon credits from CFAs, scale reforestation, and provide a model for future carbon systems. CAVEX simplifies entry into carbon markets for small projects like community forestry or solar, streamlining monitoring, reporting, and verification, and connecting them to buyers. Integrating mobile money ensures direct payments to communities, with lower commissions than typical aggregators, giving more value locally while allocating smaller shares to partners like government and Safaricom. Although building CAVEX requires substantial investment and must navigate regulatory and community challenges, it offers a transparent, trusted, and scalable pathway for small-scale climate projects, combining technology, finance, and inclusive benefits</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> Although it has probably enhanced 4RD's ability to develop carbon credit tech, the funding arrangement was sub optimal • <u>Partnerships:</u> enabled links with investors (4RD already had relationship with Safaricom) • <u>Government awareness and engagement:</u> Will probably play a role in the longer term but not specific to this contract

³⁸¹ KII Grantee, final grant report

³⁸² KII Grantee, final grant report

³⁸³ KII GSMA

³⁸⁴ All evidence from KII Partner, MNO and review of MOU

	<ul style="list-style-type: none"> • Reduced barriers to climate finance: potential in the longer term. CAVEX brings together important stakeholders, including the carbon credit buyers, Government of Kenya, Safaricom, M-Pesa, and community forestry associations, among others. It leverages digital technologies to facilitate data generation and transparency that increase the confidence of climate credit buyers, while enabling forestry association members to receive payments directly for their reforestation activities (with some share of credits going to other actors, like the GoK and Safaricom). • Access to services and utilities: NA • Individual, community or household resilience: longer term aim <p><i>Factors helping progress:</i></p> <ul style="list-style-type: none"> • Strong existing relationships with Safaricom, M-Pesa, and GSMA enabled quick initiation of the pilot. • Alignment of interests between Safaricom's CSR reforestation program and 4RD's CAVEX platform vision created a basis for collaboration. • CAVEX's design—lower aggregator fees, digital monitoring, mobile money integration—promised greater transparency and direct benefit-sharing with community forestry associations. • Potential scalability: once operational, CAVEX could connect many small projects (e.g., solar, reforestation) to carbon markets. • Visibility and networking: GSMA invited 4RD to key events, facilitating connections with investors and sector actors. • Interest from external funders such as FCDO provided further validation of the concept. <p><i>Factors that Hindered progress</i></p> <ul style="list-style-type: none"> • High upfront investment needs for CAVEX development before scaling. • Carbon market risks: volatility, complex regulation, and vested interests could limit adoption or returns. • Community engagement challenges: balancing carbon credit generation with livelihood needs requires careful incentives. • Complex multi-actor environment: multiple stakeholders with different priorities increase coordination demands. • GSMA funding structure: service contract provided resources but lacked the collaborative learning and co-research opportunities 4RD sought. 4RD could not contribute to GSMA's climate finance insights work and had to wait for results <p><i>Quality of evidence on technology working and GSMA contributions to outcomes.</i></p> <ul style="list-style-type: none"> • No significant outcomes claimed • Good enough to generate useful insights on factors that help and hinder GSMA M4D's innovation approach contributing to climate finance
Kenya	<p>Ujuzi Kilimo – precision agriculture (GSMA Innovation Fund for Climate Resilience & Adaption 2.0, 2024)</p> <p><i>Context:</i> Smallholders affected by climate change have limited access to precision agriculture technologies which are increasingly seen as an important adaptive capacity.³⁸⁵</p> <p><i>GSMA support:</i> Ujuzi Kilimo tackles the challenges of high costs and inaccessibility of soil testing services, which prevent farmers from monitoring and improving soil quality effectively through their SoilPal device, Ujuzi Kilimo aims to help farmers make data-driven decisions to enhance adaptive capacity productivity, income, and food security (absorptive capacity) while promoting sustainable agriculture practices.³⁸⁶</p>

³⁸⁵ [UjuziKilimo | Mobile for Development](#)

³⁸⁶ [UjuziKilimo | Mobile for Development](#)

	<p><i>Outcomes to which GSMA may have contributed:</i> It was too early for outcomes at the time of the evaluation</p> <p><i>Emerging insights on factors likely to influence outcomes:</i></p> <ul style="list-style-type: none"> • GSMA supported discussions with farmers regarding use of technology were appreciated³⁸⁷ • Ujuzi Kilimo was able to engage local government to support its agricultural project.³⁸⁸ • Challenges due to poor connectivity and data literacy³⁸⁹ • Ujuzi Kilimo have managed to develop relationships with local government agricultural extension services who have been willing to buy their soil testing devices³⁹⁰ • GSMA helping them explore the options for accreditation to participate in carbon markets and how this is accommodated within their business models³⁹¹. <p><i>Quality of evidence on technology working and GSMA contributions to outcomes.</i></p> <ul style="list-style-type: none"> • no significant outcomes claimed yet. • Good enough to generate useful insights on factors that help and hinder GSMA M4D's innovation approach ;
Kenya	<p>Farm to Feed increasing market for imperfect food (FTF) (GSMA Innovation Fund for Climate Resilience & Adaption 2.0, 2024)</p> <p><i>Context:</i> In Sub-Saharan Africa, consumer and retail rejection of imperfect produce that reduces income and increases food prices is a problem exacerbated by climate change.³⁹²</p> <p>Farm to Feed aims to reduce the impact of this by using tech to create a market for imperfect produce. More specifically it aims to connect smallholder farmers with buyers, helping them sell their produce, earn extra income, and reduce food waste.</p> <p><i>GSMA support:</i> The GSMA-funded project includes developing FTF's digital platforms, such as a USSD platform and an improved farm engagement app, to reach more farmers. It also aims to expand its e-commerce platform to attract more B2B buyers and establish additional supply hubs in rural Kenya to aggregate more produce. The goal is to help farmers access digital solutions, increase their incomes, and enhance resilience to climate shocks.³⁹³</p> <p><i>It was too early for outcomes at the time of the evaluation,</i></p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes We did not interview this grantee in depth so there is little evidence on learning or emerging outcomes</i></p>
Kenya	<p>Synnefa (The GSMA Innovation Fund for Anticipatory Humanitarian Action 2023)</p> <p><i>Context:</i> In Kenya, there is lack of accurate and timely data that smallholder farmers have access to, which results in poor crop yields and increased vulnerability to humanitarian crises. These farmers often have limited access to resources and are disproportionately affected by climate change.³⁹⁴</p>

³⁸⁷ [UjuziKilimo | Mobile for Development](#)

³⁸⁸ KII Grantee

³⁸⁹ KII Grantee

³⁹⁰ KII Grantee

³⁹¹ KIIs Taka Ni Mali, Aquarech, Synnefa, Ujuzi Kilimo

³⁹² [Farm To Feed | Mobile for Development](#)

³⁹³ [Farm To Feed | Mobile for Development](#)

³⁹⁴ [Synnefa | Mobile for Development](#)

	<p>Synnefa is a smart farming solutions company that offers both hardware and software to help farmers increase productivity and reduce risks, particularly in the face of unpredictable weather and harvest cycles. Their goal is to improve farmers' livelihoods by leveraging technology to help them “grow more, earn more, and live better lives” - the assumption being this addresses vulnerability and contributes towards anticipatory and absorptive capacity.</p> <p><i>GSMA support:</i> aims to help Synnefa to integrate satellite imagery into their FarmCloud platform to provide real-time data on crop health and weather patterns. They are also developing a USSD-based interface for smallholder farmers without access to smartphones or high-speed internet. The system will be tested in pilot communities and, if successful, scaled up to more regions across Africa.</p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes It was too early for outcomes at the time of the evaluation,</i></p> <p><i>We did not interview this grantee in depth so there is little evidence on learning or emerging outcomes</i></p>
Kenya	<p>WVK – The Tana River Climate Change and Livelihoods Restoration Project (T-CLIRP) (GSMA played small supportive relationship brokering role)³⁹⁵</p> <p><i>Context:</i> Land in the Tana River area was degraded as a result of unsustainable agricultural practices. World Vision Kenya was integrating tech within a community led approach to restoring ecosystem degradation through a holistic, participatory, community led resilience and NRM strategy.</p> <p><i>GSMA support:</i> The Tana River Climate Change and Livelihoods Restoration Project (T-CLIRP) was part of WVK’s broader emergency response program that offers vital services like water, sanitation, nutrition, and economic recovery to drought-affected communities across Kenya. T-CLIRP aims to improve long-term resilience by focusing on sustainable natural resource management, farmland restoration, and ecosystem strengthening for nine communities in the Delta. Along with Safaricom, World Vision Kenya, Ushahidi and communities in the Tana River Delta GSMA participated in a component that used drone and mobile phone technology to support engaged research and mapping for clearing and regenerating degraded land.</p> <p>WVK partnered with crowd-sourcing technology company Ushahidi, to enable T-CLIRP to use mobile technology to collect community feedback through geo-tagged data. The platform allows communities to voice concerns on natural resource management and document their experiences with climate change - the intention is to empower these communities to take action. Additionally, drone technology has been used to inform land restoration efforts. WVK partnered with Kenya Flying Labs to map 2,250 acres of land, identifying 250 acres for restoration. The findings were shared with communities, county government and Kenya Forest Services to create action plans for clearing and reseeded degraded areas.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> NA • <u>Partnerships:</u> GSMA supported relationships with Safaricom that provided the research team with easy to remember short codes • <u>Government awareness and engagement:</u> World Vision involved the Kenya Forest Services and county government representatives. This helped to ensure that NRM initiatives were incorporated in the official Tana River County Integrated Development Plan to improve long-term resilience. • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> NA

³⁹⁵ All evidence on this project comes from our review of [Climate change adaptation and livelihood restoration in Tana River Delta: Embracing innovative approaches and technology](#)

	<ul style="list-style-type: none"> • Individual, community or household resilience: Potential contribution to community resilience, through including evidence and actions in long term development plans <p><i>Factors that helped progress</i></p> <ul style="list-style-type: none"> • Use of familiar, accessible channels (SMS and USSD) encouraged high community engagement, especially with free, easy-to-remember shortcodes • Community-led promotion amplified reach beyond targeted participants • Geo-tagged feedback increased data integrity, enabling reliable, location-specific insights for policymaking and advocacy • Secure, compliant data platform reassured partners about privacy, enabling collaborative data use • Innovative reseeding methods (seedballs, drones) increased efficiency, reduced reliance on skilled labour, and worked in harsh conditions • Vegetation maps from drones provided valuable monitoring, revealing both positive outcomes and areas needing targeted intervention <p><i>Factors that hindered progress:</i></p> <ul style="list-style-type: none"> • Technology constraints in low-bandwidth areas limited options for richer digital engagement • Environmental challenges such as droughts and invasive species affected reseeding success in some sites <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • the case study makes fairly modest claims about outcomes and is considered reliable as the approach is consistent with World Visions participatory and community led approaches to development.³⁹⁶ • Insights on lessons and the modest contribution that highlights the benefits of GSMA being able to leverage MNOs are considered plausible and consistent with other findings. Our interest is more in the illustrative case
Kenya	<p>WVK –The Coast and Northern Kenya Integrated Emergency Response Project (KIERP)</p> <p>This project focused on increasing the adaptive and absorptive capacities of communities affected by climate change, which has worsened droughts and floods, damaging livelihoods and productivity. The project aimed to enhance financial resilience in two main ways: by creating digital village savings and loans associations (VSLAs) to promote financial inclusion, and by training farmer groups in agri-business and climate-smart agriculture. This integrated approach is intended to help to strengthen farmers’ adaptive and absorptive capacities via digital inclusion, asset building to strengthen their businesses and adapt to climate impacts.</p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes</i> No information</p>
Kenya	<p>Waste Management in Nairobi (DU support for collaborations with KARA - Kenya Alliance of Resident Associations and Taka Ni Mali with core budget)</p> <p><i>Context:</i> Effective waste sorting and management is key to reducing emissions and enabling a circular economy.³⁹⁷ Even though household waste volumes are relatively low in Kenya, significant improvements in waste management are required particularly in urban areas. Collaboration amongst different stakeholders such as governments, waste management companies and citizens groups is necessary for addressing this problem. To this end GSMA has been partnering with Taka Ni Mali, a nationally recognised player in solid waste management and the Kenya Alliance of Residents Associations.</p>

³⁹⁶ Evaluator experience

³⁹⁷ [Highlights from the GSMA Digital Urban Utilities Forum on Waste Management in Nairobi | Mobile for Development](#)

	<p>GSMA, through its M4D and Digital Utilities programmes and supported by TRANSFORM (Unilever, FCDO, EY), partnered with Taka Ni Mali, a Kenyan start-up founded by Mary Ngechu, which developed a mobile app connecting waste collectors with customers. Seeking to enhance geo-mapping and service responsiveness via USSD, GSMA brokered a partnership between Taka Ni Mali and Safaricom, formalised through an MoU.³⁹⁸ Safaricom provided IoT equipment, smart bin sensors, and technical expertise to scale the platform. Data from these bins informs municipal planning, recycling initiatives, and public awareness, while fostering community trust and creating local jobs.</p> <p>Taka Ni Mali has since become a strategic GSMA partner, raising awareness on solid waste management and the circular economy with the Kenyan government.³⁹⁹ At the same time GSMA has linked Taka Ni Mali to global networks such as the UN Global Compact and International Solid Waste Association.</p> <p>At the same time GSMA has also strengthened ties with the Kenya Alliance of Resident Associations (KARA) who are important partners in encouraging waste sorting behaviour change by households.⁴⁰⁰ In December 2024, GSMA and KARA co-hosted a national forum on digital waste management, drawing over 40 stakeholders including Taka Ni Mali from start-ups, municipalities, mobile operators, and resident associations. The event catalysed discussions on potential collaborations between Safaricom, KARA, and the County Government to improve e-waste collection and integrate digital solutions into Kenya’s wider waste management ecosystem as well as regional initiatives</p> <p><i>Outcomes to which GSMA may have contributed:</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> unknown • <u>Partnerships:</u> Separate MOUs between KARA and Safaricom and also Takni Mali and Safaricom that have started to create the conditions for an ecosystem approach to mobile enabled waste management in Kenya. Taka Ni Mali is also appreciative of linkages to global networks • <u>Government awareness and engagement:</u> government actors are engaging in discussions⁴⁰¹ • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> NA • <u>Individual, community or household resilience:</u> NA <p><i>Factors helping progress</i></p> <ul style="list-style-type: none"> • Multi-stakeholder collaboration (FCDO, GSMA, Safaricom, TRANSFORM). • GSMA’s role as a broker of partnerships and technical enabler.⁴⁰² • KARAs involvement may support educational and behavioural change components. <p><i>Factors hindering progress</i></p> <ul style="list-style-type: none"> • Reliance on convening events rather than systemic policy integration. <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • There are no significant outcomes claimed at this time. • Evidence that GSMA has helped connect these organisations to Safaricom and Taka Ni Mali to international networks is strong
Kenya	Kenya Drought Management Authority cash transfers to support absorptive capacity

³⁹⁸ KISI GSMA, staff Partner, MNO and MOU

³⁹⁹ KII GSMA, KII Partner

⁴⁰⁰ [Highlights from the GSMA Digital Urban Utilities Forum on Waste Management in Nairobi | Mobile for Development](#)

⁴⁰¹ [Highlights from the GSMA Digital Urban Utilities Forum on Waste Management in Nairobi | Mobile for Development](#)

⁴⁰² KIIs Partner, MNO

	<p><i>Context:</i> Enabling cash transfers to vulnerable populations is a priority for the Kenyan government.⁴⁰³</p> <p><i>GSMA support:</i> M4H signed a partnership with the Pakistan National Drought Management Authority at MWC Barcelona 2024 to support government involvement in a digital ecosystem that enables humanitarian cash assistance disbursement.⁴⁰⁴</p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i> weak – we have insufficient information on this potential important outcome to assess the GSMA contribution.</p>
Kenya	<p>Wonderkid – Enhancing Water Utilities (2015 Innovation Fund)</p> <p><i>Context:</i> Ensuring efficiency of water utilities is seen by GSMA as key to addressing challenges relating to climate induced water shortages.⁴⁰⁵ Wonderkid a Kenyan start-up founded in 2012 that provides a customer feedback system dubbed “Maji Voice” is viewed as a tech supported approach to enable this.⁴⁰⁶ The system was rolled out in 2013 with Nairobi Water company and customers could report complaints via SMS, USSD, a mobile app or a web platform. By 2014, it was processing 6,000 complaints per month with most of the complaints being around water billing. Wonderkid saw the opportunity to address this by developing a mobile app to digitize the process of capturing water meter readings and customer billing by the utility firm. Improved efficiency in billing would arguably contribute to a companies ability to provide efficient water utility services to customers.</p> <p><i>GSMA support:</i> The Digital Utilities programme first engaged with Wonderkid to further develop their platform and expand to other utility companies. At the conclusion of the grant in 2017, the project had supported improvement in quality of service to over 500,000 users and led to a 28% increase in revenue to the partner water companies.⁴⁰⁷ The platform has evolved to a commercially successful enterprise management system that is currently in use in Kenya and 8 other countries by over 80 clients. Since the end of the grant in 2018 GSMA have continued to provide Wonderkid access and visibility⁴⁰⁸ in fora as well as links to MNOs. As a result of this visibility and the new partnerships, Wonderkid are now working in Kenya, Malawi, Tanzania, Zanzibar, Nigeria and Liberia. However, assumptions that this improved billing and feedback system will automatically result in better water services is not supported by the broader evidence base.⁴⁰⁹</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> Enabled significant expansion into new markets and benefits for utility companies.⁴¹⁰ • <u>Partnerships:</u> GSMA brokered relationships between Wonderkid and World Water Week (WWW), International Water Association and regional forums and through GSMA publications. This visibility has helped them develop important strategic partnerships. For example, at International Water Week (August 2023), they met Imagine H2O which led to them joining their Accelerator Programme. They were also able to secure debt financing. GSMA has helped to lobby for better prices from the MNOs. Though this hasn’t reduced prices, it has enabled MNO partnerships leveraging IoT. • <u>Government awareness and engagement:</u> possible contribution • <u>Reduced barriers to climate finance:</u> NA

⁴⁰³ See reference country case study

⁴⁰⁴ M4H 2024 Annual Report

⁴⁰⁵ [World Water Day: Water for Peace | Mobile for Development](#)

⁴⁰⁶ [Wonderkid | Mobile for Development](#)

⁴⁰⁷ [Wonderkid-Multimedia-LTD-Using-mobile-to-digitally-transform-water-utilities-in-Kenya.pdf](#)

⁴⁰⁸ [The B Team | Harnessing The Power of Technology for a Better World](#), KII Partner

⁴⁰⁹ Tiago Peixoto and Jonathan Fox (2016), “When Does ICT-Enabled Citizen Voice Lead to Government Responsiveness?”, [2016 World Development Report Background Paper](#).

⁴¹⁰ KII partner

	<ul style="list-style-type: none"> • <u>Access to services and utilities</u>: access to easier payment services but these have little impact on quality of utilities • <u>Individual, community or household resilience</u>: considered unlikely <p><i>Factors helping progress:</i></p> <ul style="list-style-type: none"> • Not relevant as little evidence of contributions to meaningful climate related outcomes <p><i>Factors hindering progress:</i></p> <ul style="list-style-type: none"> • Insufficient political economy analysis to make the link <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • data relating to overall achievements and contribution from GSMA probably also reliable. However, Wonderkid’s problem analysis, assumptions, indicators, and business model do not clearly align with inclusive and meaningful climate change outcomes, despite the successful scaling up of their service and the benefits it provides to water utility firms.
Liberia	<p>J PALM Transforming sustainable palm oil through mobile blockchain technology(2022 Innovation Fund for Climate Resilience and Adaptation)⁴¹¹</p> <p><i>Context:</i> Climate change in Liberia—marked by rising temperatures, erratic rainfall, and extreme weather—threatens palm oil production, disrupting smallholder farming and wild harvesting. Climate impacts are reducing yields, endangering supply chains and rural incomes. While the industry faces deforestation and pollution risks, Liberia’s National Adaptation Plan promotes climate-smart agriculture, reforestation, and sustainable land management. Community-based programs train farmers and wild harvesters in resilient practices and alternative livelihoods to safeguard both the environment and local economies.</p> <p>J-Palm is a start-up dedicated to transforming the palm oil industry and increasing incomes and resilience through sustainable practices and innovation. It also promotes the production of clean energy from palm kernel shells to reduce deforestation.</p> <p><i>GSMA support:</i> Grant funds were used by JPALM to deploy mini-mills, enabling smallholder farmers to stabilise or increase their income, enhancing their absorptive capacity. Additionally, J-Palm developed and launched a traceability application to enhance supply chain transparency and supported harvesters to map trees and practice more sustainable practices. It also piloted a mobile app to pay harvesters.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities</u>: J PALM received a regenerative agricultural certification and attracted support from USAID and a contract with a soap manufacturer with potential earnings of approximately \$550,000 during the grant • <u>Partnerships</u>: NA • <u>Government awareness and engagement</u>: rNA • <u>Reduced barriers to climate finance</u>: the project did not achieve its aims of using the health of the trees to access climate finance from carbon offsetting. • <u>Access to services and utilities</u>: NA • <u>Individual, community or household resilience</u>: those surveyed from the 3000 Palm oil harvesters supported by JPalm reported increased incomes that GSMA associated with improved absorptive and adaptive capacity. Improved mills were also associated with reductions in water use and pollution. Reports of 12,000 hectares of land benefiting from improved

⁴¹¹ All of the evidence reported here comes from the GSMA case study that we were advised was the most reliable synthesis of evidence collected from the partner by GSMA and organisations contracted to support MEL GSMA JPALM Draft Case Study

	<p>forestry practices also suggest environmental benefit, however. at the end of the project most harvesters were unaware of the app for mapping trees suggesting this had contributed little to land improvements and few were using mobile money apps for payment.</p> <p><i>Factors that helped progress</i></p> <ul style="list-style-type: none"> • Traceability helped sales and played a critical role in J-Palm achieving both Organic and Regenified (regenerative agriculture) certifications, • The app and certifications positioned J-Palm to export oils to the USA, contributing to better-than-projected revenues and securing entry into key global markets. <p><i>Factors that hindered progress</i></p> <ul style="list-style-type: none"> • Challenges accessing spare parts and maintaining mills • Low tech literacy/engagement of harvesters with apps: harvesters were already committed to preserving trees and 87% of harvesters were unaware of J-Palm’s tree mapping feature, designed to help protect wild palm forests. • Time taken for carbon accreditation process meant this could not be pursued • Transaction costs of mobile money: Only 4% of the harvesters surveyed were being paid for their palm oil and palm kernels by their buyers via mobile money. 78%, were interested in being paid via mobile money, whilst 20% were concerned that fees would reduce their total income. • Risks of perverse incentives:⁴¹² While harvesters generally do not engage in tree cutting, many indicated they would be open to financial incentives to further discourage deforestation. <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • weak single source, however it is plausible that block chain led to J PALM certification and increased income. It is also plausible that mills increased income. However other challenges relating to carbon credits, use of the tree health app and interest in incentives for existing practices raise questions whether about whether assumptions regarding the added value of tech solutions hold. • GSMA contribution to any outcome if validated would likely be plausible
Nepal	<p>Geo Krishi – climate information and agricultural advice (2022 Innovation Fund for Climate Resilience and Adaptation)</p> <p><i>Context:</i> Without technical understanding or advice, smallholder farmers in Nepal are unable to respond to the risks of climate change. Extension services, climate-smart tools and technologies are often inefficient and not tailored to the changing climate.⁴¹³ GeoKrishi helps smallholder farmers adapt to climate stressors and adopt climate-smart agricultural practices through digital learning content and advisory services.</p> <p><i>GSMA support:</i> GeoKrishi is Nepal’s first fully integrated, data-driven digital agriculture platform designed to help remove the financial, technical and cultural barriers preventing farmers from accessing and using information to improve farm productivity and maximise profitability. The GSMA supported GeoKrishi to upgrade their existing system to expand the reach of their bundled smart agricultural solutions. The GSMA grant was also used to build a sustainable public-private-community business model by engaging closely with local government, local service providers and farmer cooperatives.</p>

⁴¹² Evaluator analysis

⁴¹³ [GeoKrishi | Mobile for Development](#)

	<p><i>Outcomes to which GSMA may have contributed</i>⁴¹⁴</p> <ul style="list-style-type: none"> • Business capabilities: case suggests growing capacities, increasing offer • Partnerships: Geo Krishi developed a partnership with a mobile network operator (MNO) to send subsidised SMS weather and advisory alerts to farmers, and provide subsidised internet data packages for farmers to access the GeoKrishi app. It plans to also partner with telecoms operators to offer tailored packages for marginalised communities. Geo Krishi attracted \$760,000 during the grant • Government awareness and engagement: Local municipalities were trained to support Geo Krishi's efforts to increase the uptake of its solution and data collected enables them to plan outreach services. • Reduced barriers to climate finance • Access to services and utilities: NA • Individual, community or household resilience: Geo Krishi reported that most farmers surveyed, the majority of whom were women had increased anticipatory and adaptive capacities resulting from applying information on climate forecast or climate smart sustainable advisory information. Despite significant investment in offline support, it still proved expensive and difficult to reach particularly vulnerable farmers, however. <p><i>Factors that helped:</i></p> <ul style="list-style-type: none"> • Support from local government including financial <p><i>Factors that hindered</i></p> <ul style="list-style-type: none"> • Unexpected costs complex partnerships • Low connectivity and literacy of poor farmer • Online training being an ineffective modality • Not being able to always access and share current weather information <p><i>Quality of evidence on technology working and GSMA contributions to outcomes</i></p> <ul style="list-style-type: none"> • Low- appears that support enabled development of business and solutions that were appreciated by vast majority of users, but hard to verify claims of increased incomes and yields and what these mean for adaptive capacity in such a short grant. Still struggling to reach poor farmers • GSMA contribution to enabling relationship with MNO and shift to more effective approach to off line support looks plausible but hard to interpret full impact without primary research
Nepal	<p>Digital Utilities convened government actors in conversations on public private partnerships for improved water services and reducing energy emissions⁴¹⁵</p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes</i> NA no outcomes claimed</p>
Nigeria	<p>Co-Amama – information on climate smart agriculture and drought resistant seeds 2022 Innovation Fund for Climate Resilience and Adaptation⁴¹⁶</p> <p><i>Context:</i> More than 70% of Nigerians live in rural agrarian communities whose productivity is affected by the effects of climate change such as heavy rains and prolonged periods of drought. These farmers lack access to information on how to adapt or anticipate hazards as well as crucial products like drought-resistant seeds.</p>

⁴¹⁴ All remaining content from case study as recommended by GSMA https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2024/07/Case-Study_GeoKrishi_Digitising-Agriculture-in-Nepal_20240729.pdf

⁴¹⁵<https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/digitalising-energy-and-water-services-in-nepal/>

⁴¹⁶ Based on single source [GSMA Strengthening-Climate-Resilience-in-Nigeria-through-Digital-Market-Hubs-CoAmama_2024.pdf](https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/digitalising-energy-and-water-services-in-nepal/)

	<p>CoAmana's digital agricultural marketplace management and trade platform provides farmers and stakeholders in the agri-value chain with tools that aim to address these issues helping farmers manage financial risks related to drought conditions, purchase drought-resistant seeds and access information on best practices and financial services.</p> <p><i>GSMA support:</i> CoAmana's digital platform provides tools that support sales and procurement, facilitate price comparisons, enable digital payments, offer embedded financial services like digital credit and insurance and provide digital information, such as best practices and weather updates. CoAmana received a GSMA grant in November 2022 to increase reach and accessibility by enhancing the existing technology; expanding their field support by recruiting more agents to assist farmers and build trust in the digital system. CoAmana also focused on rural communities, building a USSD menu for basic feature phones. By bundling agricultural advice with credit and other services, they hoped to keep prices down.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> improvements to their digital marketplace; agents supplying drought resistant seeds which increased revenues relationships with MNOs and investment. They also announced a \$756,000 investment from Village Capital during the grant⁴¹⁷. • <u>Partnerships:</u> with MTN Nigeria's MoMo Pay service to integrate their mobile money services in the Amana Market platform.⁴¹⁸ • <u>Government awareness and engagement:</u> NA • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> NA • <u>Individual, community or household resilience:</u> increased women farmer's access to solar powered water pumps and advisories delivered by mobile and USSD improved farmers adaptive capacity, yields and income.⁴¹⁹ Increasing women's income and reducing emissions through heat pumps adds an interesting dimension. Note older farmers did not trust the technology and reaching the unconnected with information was challenging. <p><i>Factors that helped:</i></p> <ul style="list-style-type: none"> • Enhancing the existing technology with a USSD feature for normal phones • Expanding their field support by recruiting more agents to reach farmers in rural communities and build trust in the digital system. <p><i>Factors that hindered</i></p> <ul style="list-style-type: none"> • Low digital and other types of literacy that meant older farmers less able to adopt technology • Poor connectivity and network coverage • Government pricing policy challenged competitiveness during grant period <p><i>Quality of evidence on technology working and GSMA contributions to outcomes</i></p> <ul style="list-style-type: none"> • Low- appears that support enabled changing the nature of the business but hard to verify claims of increased incomes and yields and what these mean for adaptive capacity in such a short grant • GSMA contribution to enabling relationship with MNO and shift to more effective approach to off line support looks plausible but hard to interpret without primary research
Nigeria	Hello Tractor, a tractor rental project (Climate adaptation and resilience IF 2022) ⁴²⁰

⁴¹⁷ GSMA M4D Donor reporting KII spreadsheets

⁴¹⁸ [GSMA Strengthening-Climate-Resilience-in-Nigeria-through-Digital-Market-Hubs-CoAmana_2024.pdf](#)

⁴¹⁹ [GSMA Strengthening-Climate-Resilience-in-Nigeria-through-Digital-Market-Hubs-CoAmana_2024.pdf](#)

⁴²⁰ All content taken from draft of final case study

	<p><i>Context:</i> climate change is worsening Nigeria’s mechanised agriculture shortfall, bringing more intense floods, landslides, and desertification.. In a rainfed farming economy, erratic rainfall delays tractor services, reducing yields and incomes for farmers and tractor owners. Combined with low mechanisation and poor technology adoption, these weather extremes are severely disrupting agricultural activities and deepening productivity challenges in Nigeria. Hello Tractor is a start-up based in Nigeria, Kenya, Uganda, Rwanda and Ethiopia that provides affordable and timely agricultural mechanisation services across 17 countries in Africa. It connects farmers in need of mechanisation services to versatile and manoeuvrable tractors suited for small plots of land.</p> <p><i>GSMA Support:</i> Hello Tractor developed a weather-based demand forecast tool that can produce a dynamic map. This map notifies farmer’s demand for services based on historical associations between rainfall activity (and other variables) and tractor behaviour within that customer’s market, all supported by weather data. The Innovation Fund was also used to implement a PAYG financing model and for conducting 15 training and marketing workshops for over 600 farmers regarding Hello Tractor’s services.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> increased income • <u>Partnerships:</u> NA • <u>Government awareness and engagement:</u> NA • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> 17,000 plus access to tractor services and 3,500 advisory • <u>Individual, community or household resilience:</u> booking agents and tracking agents increased income, farmers availing tractors may save time and also employ less damaging ploughing practices⁴²¹. <p><i>Factors that helped:</i></p> <ul style="list-style-type: none"> • None identified <p><i>Factors that hindered</i></p> <ul style="list-style-type: none"> • Low client awareness of climate change impacts • Clients desire for personal advice from booking agents but weak incentives for tractor booking agents to provide agricultural advice • Incorrect assumptions in the initial model to forecast tractor demand • Poor roads that make travel between farms arduous <p><i>Quality of evidence on technology working and GSMA contributions to outcomes</i></p> <ul style="list-style-type: none"> • The links between the service and climate change outcomes appear tenuous and there were fewer references to common benefits of a relationship with GSMA. Thus there was no analysis of GSMA contribution
Nigeria	<p>Public private partnerships for improved waste management and other services.⁴²²</p> <p><i>Context:</i> Faced with rapid urbanisation and increased motorization, effective waste management and sustainable transport solutions are needed in most African cities including Lagos.</p> <p><i>GSMA support:</i> In 2021, together with Utopia, Digital Utilities convened government actors in conversations on public private partnerships for improved waste management and other services.⁴²³ This virtual invite-only convening featured</p>

⁴²¹ GSMA draft impact case study

⁴²² [Enabling Government-Innovator partnerships in Lagos: Insights from our workshop | Mobile for Development](#)

⁴²³ [Enabling Government-Innovator partnerships in Lagos: Insights from our workshop | Mobile for Development](#)

	<p>stakeholders from both the public and private sectors as well as mobile operators, enabling organisations, and civil society.</p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • Not relevant as no significant outcomes claimed.
Nigeria	<p>Initiative: Koolboks’ pay-as-you-go freezers – (Innovation Fund May 2021, for Digital Urban Services)⁴²⁴</p> <p><i>Context:</i> Nigeria faces a dual challenge: over 85 million people lack reliable grid electricity, and diesel generator capacity exceeds grid generation, driving high costs and emissions. Meanwhile, up to 40% of food is lost post-harvest due to poor storage and transport infrastructure.</p> <p>Koolboks addressed these issues with a pay-as-you-go (PAYG) solar-powered refrigeration solution that uses both ice and batteries to store solar energy, reducing off-grid refrigeration costs by 40%. The units are leased on a lease-to-own basis, with embedded locking devices linked to payment status. Customers pay in affordable weekly or monthly instalments via the PAYG model, making the technology accessible to those without upfront capital or credit.</p> <p><i>GSMA support:</i> the IF supported the scale-up of a pilot in Ijora market to fish traders in Lagos and peri-urban areas, including procurement, assembly, distribution, and installation of 140 freezer solar power freezer units. solar powered refrigeration solution, one that was offering continuous cooling and also made affordable through this pay as you go leasing model.⁴²⁵ The initiative combined clean energy, digital innovation, and inclusive finance to tackle energy access, food waste, and income generation simultaneously Key elements of the model included:</p> <ul style="list-style-type: none"> • IoT monitoring to track payments and usage, reducing defaults and enabling robust KYC processes—resulting in a portfolio-at-risk of ~3%. • Innovative financing: IoT-enabled data allowed Koolboks to partner with Untapped Global for asset-backed lending, collateralising receivables. • Climate finance potential: partnership with Carbon Clear to explore carbon-avoidance credits from avoided diesel use, tapping into the growing voluntary carbon market. <p><i>Outcomes to which GSMA may have contributed:</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> Koolboks had raised £9.53m since receiving GSMA grant in March 2022 and established several partnerships that were enabling expansion into different countries. While the relationship with GSMA had helped, interviewers found it difficult to attribute specific relationships to GSMA.⁴²⁶ • <u>Partnerships:</u> though the business did not suit an MNO partnership, with support from GSMA they forged other successful relationships and subsequently partnered with Orange Energy⁴²⁷ allowing expansion to 12 African countries. They are also in initial engagements with other mobile operators across the continent. • <u>Government awareness and engagement:</u> NA • <u>Reduced barriers to climate finance:</u> Koolboks is experimenting with/interested in accreditation for carbon markets.⁴²⁸ • <u>Access to services and utilities:</u> provide 140 mostly women traders with reliable solar power, reducing carbon emissions,

⁴²⁴ Apart from a few points made at interview, most evidence comes from this GSMA blog <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/digital-grantees-portfolio/koolboks/>

⁴²⁵ KII Grantee

⁴²⁶ KII Grantee

⁴²⁷ <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/digital-grantees-portfolio/koolboks/>

⁴²⁸ KII Grantee

	<ul style="list-style-type: none"> • Individual, community or household resilience: boosting incomes and reducing organic waste emissions. 90% of users report improved well-being with manu experiencing reduced waste⁴²⁹. 14% of the customers gained new access to solar power that helped with unreliable electricity supply. <p><i>Factors helping progress:</i></p> <ul style="list-style-type: none"> • PAYG model making technology affordable. • IoT integration for monitoring, asset tracking, and financing leverage based on collateralising receivables. • Strong KYC processes reducing repayment risk. • Targeted gender-sensitive marketing driving adoption. • Partnerships for climate finance and external lending. <p><i>Factors hindering progress:</i></p> <ul style="list-style-type: none"> • High costs of imported parts drove need to set up local plants. • Voluntary carbon market credibility challenges limiting climate finance potential. <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • while we could not triangulate impacts on traders, the success of business reported in the blog was triangulated during interview. • There is plausible evidence that GSMA played a significant role in brokering relationships and endorsing Koolbox that has contributed to investment and growth but more difficult to attribute specific partnerships.
Pakistan	<p>SMART Villages initiative (funded by the USF)</p> <p><i>Context:</i> A GSMA policy officer working on technology for digital inclusion saw an opportunity to extend mobile-enabled services to rural communities in line with government policy.⁴³⁰ Villages were selected based on criteria such as population size, socioeconomic need, climate vulnerability, agricultural potential, security, supportive local authorities, low connectivity, and proximity to infrastructure.⁴³¹</p> <p>Following introductory meetings in September 2021, the GSMA Digital Utilities team joined the initiative, offering expertise on digital inclusion to the Pakistan government and other stakeholders, including Jazz,⁴³² a mobile network operator (MNO) and GSMA partner.⁴³³</p> <p>In November 2021, GSMA, USF, and Jazz co-hosted a workshop as part of GSMA’s standard approach to fostering supportive mobile ecosystems—engaging MNOs early to ensure they can support startups with connectivity as and where needed. During the workshop, Gokina (near Islamabad) was selected as the pilot site for digital inclusion efforts and a USF-funded competition then led to the selection of three pilot projects:</p> <ul style="list-style-type: none"> • Ecofire – clean cooking stoves • Pakistan Agricultural Research – climate-smart agriculture • SBEEC (SB Electronics Engineering and Control Pvt Ltd) – smart metering for energy efficiency <p>Although SBEEC’s pilot showed promising results, political disruptions ultimately led to the suspension of all three initiatives, despite findings being shared with USF.</p> <p><i>Outcomes to which GSMA may have contributed</i></p>

⁴²⁹ [Solar-Powered Cooling Solutions: Koolboks freezers in Nigeria | Mobile for Development](#)

⁴³⁰ KII GSMA staff

⁴³¹ KII GSMA staff, OH Report

⁴³² [IT minister opens Gokina Smart Village project - Pakistan - Business Recorder](#)

⁴³³ KII GSMA staff, OH Report

	<ul style="list-style-type: none"> • Business capabilities: Of the three start-ups supported by the SMART Villages project, only SBECC progressed far enough to achieve results.⁴³⁴ The other two initiatives faced setbacks during political disruption.⁴³⁵ Ecofire stalled when beneficiaries couldn't be shortlisted, while PAR's efforts on water management training for eight attendees saw no further progress. • Partnerships: GSMA used funding from USF to incentivise Jazz's participation⁴³⁶ • Government awareness and engagement A SMART Villages pilot demonstrated how smart metering could identify energy wastage and electricity theft in schools. This informed an energy-saving model shared with the United Services Fund for potential replication elsewhere.⁴³⁷ Given regional concerns about energy loss, results were reportedly shared in Nepal.⁴³⁸ • Reduced barriers to climate finance: NA • Access to services and utilities: NA • Individual, community or household resilience: NA <p>Political disruption in April 2022 stalled Smart Villages and other GSMA initiatives.⁴³⁹ Following political transition, GSMA renewed support, with site visits in August 2024 leading to MIT launching activities in a second village in December 2024 and plans for a third.⁴⁴⁰</p> <p><i>Factors likely to have helped progress:</i>⁴⁴¹</p> <ul style="list-style-type: none"> • Clear selection criteria linking feasibility with climate vulnerability. • An ecosystem approach—leveraging USF, MNOs, startups, and government relationships to deliver integrated services for underserved communities. • MA government relationships and political awareness. <p><i>Factors that hindered progress</i></p> <ul style="list-style-type: none"> • Political instability disrupting operations. <p><i>Quality of evidence on technology working and GSMA contributions to outcomes.</i></p> <ul style="list-style-type: none"> • no significant outcomes claimed. • Reasonable triangulation by two key GSMA staff. Good enough to generate useful insights on factors that help and hinder GSMA M4D's SMART Villages implementation as
Pakistan	<p>Lahor Waste Management Company Smart Bins (supported by OneByte)</p> <p><i>Context:</i> In 2023, GSMA's M4D Digital Utilities (DU) team began a partnership with the Lahore Waste Management Company (LWMC), a city-contracted waste collector, to explore mobile-enabled solutions for inefficient waste management in Lahore.⁴⁴² The initiative was prompted by GSMA's new focus on waste management, and the DU lead leveraged a personal connection with the LWMC CEO to propose an innovation challenge for tech-based solutions.⁴⁴³ LWMC welcomed the idea, partly for its media potential, but funding constraints meant alternative financing was needed.⁴⁴⁴</p>

⁴³⁴ KII GSMA staff, OH Report

⁴³⁵ KII GSMA staff, OH Report

⁴³⁶ 2 KIIs GSMA staff

⁴³⁷ Outcome Harvest Learning report based on Smart Village Pakistan Outcome Map: reference the associated PowerPoint Slide #12.)

⁴³⁸ KII GSMA staff

⁴³⁹ KII GSMA staff

⁴⁴⁰ KII GSMA staff

⁴⁴¹ Evaluator analysis

⁴⁴² KII GSMA staff

⁴⁴³ KII ex GSMA staff

⁴⁴⁴ KII ex GSMA staff

	<p><i>GSMA support:</i> Rather than pursuing slow-moving government funds, GSMA approached Onebyte, a venture studio whose CSR priorities aligned with the concept.⁴⁴⁵ Onebyte agreed to co-support a competition seeking sustainable, cost-effective, tech-enabled waste bins.⁴⁴⁶ The winning proposal, from the Centre for Urban Information Technology and Policy at LUMS University, introduced an IoT and AI-based system to monitor bin fill levels, sort waste, and calculate fuel-efficient collection routes, reducing emissions and operational costs.⁴⁴⁷</p> <p>The solution, powered by battery-charged smart bins, was deployed jointly by LWMC and LUMS. It aimed to improve waste collection efficiency, minimise fuel use, and reduce associated emissions.⁴⁴⁸ However, the approach primarily targeted cost savings for the company and city authority rather than addressing the broader climate vulnerabilities faced by poor communities.⁴⁴⁹ It also did not tackle key risks of poor waste management, such as methane emissions from unmanaged waste, flood risks from clogged drainage, or opportunities to promote circular economy practices and inclusiveness.⁴⁵⁰</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> NA • <u>Partnerships particularly with MNOs:</u> Relationships between LWMC, OneByte, LUMS⁴⁵¹ • <u>Government awareness and engagement:</u> LWMC is a state owned enterprise and may have gained some increased awareness of the possibilities of IOT but it has been involved in many similar research initiatives over the years⁴⁵² • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> Lahore Waste Management Company (LWMC) smart bin initiative saw no sustained use. According to LWMC, technical issues with battery power and theft — though it's unclear which bin components were stolen — hindered implementation. • Individual, community or household resilience: NA <p><i>Factors that helped progress</i></p> <ul style="list-style-type: none"> • DU lead's personal relationship with LWMC leadership.⁴⁵³ • LWMC's interest in innovation and positive media coverage.⁴⁵⁴ • Partnership with Onebyte to bypass government red tape and secure funding.⁴⁵⁵ • Competitive challenge model attracting high-quality proposals.⁴⁵⁶ • Technical expertise from LUMS in IoT and AI for waste management.⁴⁵⁷ <p><i>Factors that hindered progress</i></p> <ul style="list-style-type: none"> • Limited funding beyond the IF fund.⁴⁵⁸ • Focus on cost savings over climate vulnerability or inclusiveness.⁴⁵⁹ <p><i>Quality of evidence on technology working and GSMA contributions to outcomes.</i></p>
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⁴⁴⁵ KII ex GSMA staff

⁴⁴⁶ [\(1\) Post | LinkedIn](#)

⁴⁴⁷ KII ex GSMA staff

⁴⁴⁸ [LWMC turns to AI to modernise waste management operations - Pakistan - Business Recorder](#)

⁴⁴⁹ Evaluator analysis

⁴⁵⁰ Evaluator analysis

⁴⁵¹ KII GSMA staff

⁴⁵² For example [LWMC's Milestone: 21 million Tonnes of Waste Removed - ProProperty](#)

⁴⁵³ KII GSMA Staff

⁴⁵⁴ KII GSMA Staff

⁴⁵⁵ KII GSMA Staff

⁴⁵⁶ KII GSMA Staff

⁴⁵⁷ KII GSMA Staff

⁴⁵⁸ KII GSMA Staff

⁴⁵⁹ KII GSMA Staff

	<ul style="list-style-type: none"> • no significant outcomes claimed. • We were unable to triangulate accounts of progress made and GSMA contributions. Nonetheless interviews provide useful and plausible insights on factors that helped and hindered progress
Pakistan	<p>Public-private partnerships to advance climate-tech investment; water and sanitation; and clean cooking (Digital Utilities)</p> <p><i>Context:</i> Urban services in Pakistan were under pressure due to overlapping challenges of rapid urbanisation, climate change and urban inequality.⁴⁶⁰</p> <p><i>GSMA support:</i> In March 2022, the DU team convened a virtual multistakeholder workshop on the future of urban utilities in partnership with the National Incubation Centre of Pakistan.⁴⁶¹ This stimulated discussions on how to address pressure on urban services. More specifically participants discussed the potential of public-private partnerships to advance climate-tech investment; water and sanitation; and clean cooking. Imran Ghazali, the Official Government Spokesperson for Digital Media who was a key speaker left his post soon after which presumably stalled work on this initiative.⁴⁶²</p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i> NA- there is no outcome claimed</p>
Pakistan	<p>AI Forest Fires – led by CIU with support from FCDO</p> <p><i>Context:</i> Forest fires are a significant risk in Pakistan, and COP27 discussions spurred government interest in improved management.⁴⁶³ This initiative built on a pilot project (2021–2024) by WWF Pakistan and LUMS, supported by FCDO’s Frontier Tech Hub.⁴⁶⁴ Using a low-cost, community-based approach, local government staff deployed thermal sensors and machine learning to identify vulnerable areas.⁴⁶⁵ Community engagement raised awareness and addressed cultural and security concerns about equipment locations.⁴⁶⁶</p> <p><i>GSMA support:</i> Responding to a GSMA Climate Impact Unit (CIU) call for insights, FCDO proposed a project to sensitise regulators and stakeholders to AI’s potential forest fire mitigation.⁴⁶⁷ GSMA’s CIU sought to move beyond an approach that merely shared insights and instead designed a more embedded approach that combined a desk review and a workshop where WWF and LUMS together with other stakeholders shared experiences related to FF management.⁴⁶⁸ During the workshop representatives from government, FCDO, USF, and GSMA IF partners Buraq and BKK discussed challenges and opportunities for collaborative action on a more significant AI FF management initiative at the national level.⁴⁶⁹ USF incentives led PTA, Zong, and Jazz to offer tower installation despite no business case favouring the commercial interests of MNOs.⁴⁷⁰</p> <p>In 2024, CIU published a blog and report Combatting forest fires with AI in Pakistan combining insights from the meeting with lessons from international practice. The report outlined components of a national AI-driven early warning system, highlighted</p>

⁴⁶⁰ <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/insights-from-the-future-of-urban-utility-services-in-pakistan-virtual-workshop>

⁴⁶¹ <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/insights-from-the-future-of-urban-utility-services-in-pakistan-virtual-workshop>

⁴⁶² (7) [Imran Ghazali | Linkedln](#)

⁴⁶³ KII Donor

⁴⁶⁴ KII Donor

⁴⁶⁵ WWF and LUMS Project Reports, KII Partner

⁴⁶⁶ WWF and LUMS Project Reports

⁴⁶⁷ KIIs GSMA staff and Donor

⁴⁶⁸ KII GSMA staff

⁴⁶⁹ KII GSMA staff

⁴⁷⁰ KII GSMA staff

	<p>IoT use by Crop2X, Buraq, and BKK, and was shared online with key stakeholders.⁴⁷¹ In an effort to inspire collaboration and collective action, the report was shared with key stakeholders in an online session in 2024.⁴⁷² Subsequent CIU work brought together PTA, Ministry of Tech, and national/provincial agencies, generating strong interest from Punjab and Khyber Pakhtunkhwa. Despite budget constraints, the Punjab NDMA issued a tender to pilot its own AI system—likely influenced by both the WWF–LUMS pilot and GSMA’s convening role.⁴⁷³</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities</u>: NA • <u>Partnerships</u>: Different actors including grantees and MNOs came together. PTA, Zong, and Jazz offered to install towers • <u>Government awareness and engagement</u>: GSMA influenced the Ministry of Climate Change’s decision to launch a Green Tech Hub⁴⁷⁴ as well as NDMA and Punjab Disaster Management Agency engagement on the potential of AI for early warning systems and forest fire management. This government engagement is likely to have influenced the provincial government’s decision to tender for a pilot AI forest fire management system late last year. • <u>Reduced barriers to climate finance</u>: NA • <u>Access to services and utilities</u>: NA • <u>Individual, community or household resilience</u>: NA during the grant but has potential to contribute to community capacity to anticipate and reduce harm in the longer term <p><i>Factors helping progress:</i></p> <ul style="list-style-type: none"> • GSMA staff lead with strong understanding of context⁴⁷⁵ • Existing WWF–LUMS pilot providing proof of concept.⁴⁷⁶ • GSMA convening power, leveraging relationships and MNO commitments.⁴⁷⁷ • USF incentives removing commercial barriers for tower installation⁴⁷⁸ • Stakeholder workshops enabling cross-sector dialogue⁴⁷⁹ • Publication and dissemination of practical, context-specific recommendations <p><i>Factors hindering progress</i></p> <ul style="list-style-type: none"> • Severe government budget constraints⁴⁸⁰ • Competing demands for immediate disaster response⁴⁸¹ • Unclear causal links between convening efforts and provincial action⁴⁸² <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • The evidence on process the involvement of different actors in a workshop that was greatly appreciated is strong. • While it is plausible that GSMA contributed to the tendering of further work by the Punjab NDMA, many other actors and factors played a role. Nonetheless the GSMA process and convening will likely improve the quality of this work in the future
Pakistan	EW4All Humanitarian Connectivity Charter (M4H)

⁴⁷¹ KII GSMA staff
⁴⁷² KII CIU and Partner
⁴⁷³ Tender document
⁴⁷⁴ KII Donor
⁴⁷⁵ KII GSMA staff
⁴⁷⁶ KII Donor
⁴⁷⁷ KII GSMA staff
⁴⁷⁸ KII Partner
⁴⁷⁹ KII GSMA staff
⁴⁸⁰ KII GSMA
⁴⁸¹ KII GSMA
⁴⁸² KII GSMA Staff

Context: GSMA plays a leading role in the UN EW4All (Early Warning for All) Initiative through its Mobile for Humanitarian Innovation (M4H) programme, as a member of its Pillar 3 (led by the International Telecommunication Union), on warning dissemination and communication. The GSMA Director General sits on the EW4All High-Level Advisory Panel.

GSMA supports EW4All in all four activity areas of the GSMA Climate Impact Narrative:

- **Convening and partnerships:** Bringing together mobile industry and multi-sectoral partnerships to develop early warning systems (EWSs).
- **Investment:** Through the Innovation Fund, supporting innovative digital EWS solutions, including Synnefa (Kenya), Tahmo (Ghana), Komunidad (Philippines) and Buraq (Pakistan).
- **Research and knowledge-sharing:** Publishing studies on mobile-enabled EWSs, including cell broadcast technology and inclusive risk communication. Promoting best practices through GSMA's Mobile World Congress and M360 events.
- **Technical support:** Assisting mobile network operators and partners to develop user-focused EWSs.

M4H organised three regional workshops in 2023 and 2024 across the Caribbean, Asia Pacific and Africa. These brought together diverse stakeholders to discuss the role of telecommunications in disaster preparedness, response, and recovery, with EWS as a key focus. The workshops operated under the [GSMA Humanitarian Connectivity Charter](#) – shared principles adopted by mobile industry actors to enhance partnership and coordination for emergency preparedness and response.

The convenings have generated country-level coordination and development of EWSs. A notable example is the August 2024 Statement of Commitment signed between GSMA and MNO Jazz in Pakistan, committing to collaborate on developing and implementing mobile-enabled EWSs.

In December 2024, GSMA Pakistan convened another many of the same participants from the earlier meeting on forest fires.⁴⁸³ Participants explored opportunities for mobile technologies to contribute to a national early warning system for all, once again indicating a level of coherence across the climate portfolio. The EW4All meeting was described by one NGO participant as well-structured with concrete outcomes.⁴⁸⁴ This meeting certainly built on GSMA contributions to COP 28 exploring the role of mobiles in EW4ALL.⁴⁸⁵ GSMA's Country Lead for Digital Transformation is advancing follow-up activities to align the plan with HCC's emergency connectivity goals.⁴⁸⁶ Efforts include strengthening MNO capacity, improving message coordination, and addressing data privacy concerns. Opportunities for climate-related funding from UNICEF and USF are also being explored, which is perhaps an example of increasing coherence with other actors in the ecosystem. These will have a focus on expanding services in flood-prone areas.

Outcomes to which GSMA may have contributed

- **Business capabilities:** NA
- **Partnerships:** Key stakeholders including UNDRR, IFRC, WMO, and ITU, agreed to collaborate on mobile-enabled humanitarian early warning systems.⁴⁸⁷ Agreements around the meeting formalized different partnerships and commitments while also making policy recommendations on how to create a conducive environment and strengthen capacity for

⁴⁸³ KIIs M4H, Grantee

⁴⁸⁴ KII Partner

⁴⁸⁵ [Mobile-powered Early Warning Systems key to disaster preparedness: Jazz CEO](#)

⁴⁸⁶ KII GSMA staff

⁴⁸⁷ GSMA Staff

	<p>implementation.⁴⁸⁸ JAZZ signed an MOU with GSMA and is engaging the government in taking this forward.⁴⁸⁹ Though not part of formal agreements, grantees were also able to offer ideas on how their use of technology might contribute information to the system, but some found legal restrictions regarding them not being able to disseminate warnings somewhat frustrating.⁴⁹⁰ According to one partner the meeting provided them with valuable opportunities to engage with government actors and MNOs as well as the PTA.</p> <ul style="list-style-type: none"> • Government awareness and engagement: Discussions and subsequent actions This involves raising government awareness about the potential for different stakeholders to contribute to an actionable framework for mobile enabled early warning systems.⁴⁹¹ • Reduced barriers to climate finance: NA • Access to services and utilities: long term potential • Individual, community or household resilience: long term potential • GSMA is also collaborating with other actors to raise government awareness about the potential of a multi stakeholders actionable framework for mobile enabled early warning systems.⁴⁹² <p><i>Factors helping progress:</i></p> <ul style="list-style-type: none"> • Assumed: alignment with government policy and interest • GSMA convening power <p><i>Factors hindering progress</i></p> <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • Weak meeting was effective but we don't know outcomes • GSMA obviously a player but nature of encounters and low base knowledge of evaluators regarding this intervention made it difficult to determine precise contribution of GSMA versus other actors involved and the impact
Pakistan	<p>BaKhabar Kissan providing local weather and agricultural advice to (BKK) (2022 Climate Resilience and Adaptation Innovation Fund)</p> <p><i>Context:</i> 8.2 million smallholder farmers in Pakistan work to meet the basic food and nutrition requirements of the country's population.⁴⁹³ However, a lack of weather data stations and high-quality weather data reduces their anticipatory and adaptive capacities. This hinders food security and has left poor communities, particularly farmers, even more vulnerable to the effects of climate change.⁴⁹⁴ BaKhabar Kissan (BKK) aim to address this problem through a network of weather stations providing hyperlocal weather information as well as enabling access to agricultural expertise through digital platforms.⁴⁹⁵</p> <p><i>GSMA support:</i> With GSMA innovation grant support, BKK improved its local forecasting capabilities and enhanced mobile-based climate advisory services providing farmers with guidance on sustainable farming practices tailored to local climate conditions and challenges. This includes advice on crop rotation and pest and disease management. BKK has tested its IVR offer in some areas and is learning and adapting it with the aim of reaching more users in more local languages. Evidence collected by GSMA for a case study convincingly demonstrates that BKK's freemium weather information service grew significantly over the period of the grant by over 6</p>

⁴⁸⁸ KII Partner and GSMA Staff

⁴⁸⁹ [Mobile-powered Early Warning Systems key to disaster preparedness: Jazz CEO](#)

⁴⁹⁰ KII GSMA partner

⁴⁹¹ KII GSMA partner

⁴⁹² [Framework plan shared by M4H](#)

⁴⁹³ [BaKhabar Kissan \(BKK\) | Mobile for Development](#)

⁴⁹⁴ [BaKhabar Kissan \(BKK\) | Mobile for Development](#)

⁴⁹⁵ [Khabar Kissan \(BKK\) | Mobile for Development](#)

million and is trusted and used. It also suggests that the improved guidance achieved over 30,000 new subscribers a month. It is difficult however to assess how many of the 40,000 plus farmers cited as using advice to adapt had been able to avail of GSMA supported features

Outcomes that GSMA may have contributed to

- Business capabilities: Financial management capacity assumed to increase potential to attract investment Despite a massive increase in subscribers, investment in training women and experiments with IVR, it was still challenging to establish a pricing structure that was commercially viable and reached vulnerable farmers. Therefore, BKK was aiming to generate additional revenue from bundling financial services with its offer.⁴⁹⁶
- Partnerships BKK already had relationships with two MNOs in Pakistan prior to the grant, but GSMA helped strengthen these and BKK developed relationships with two others.⁴⁹⁷
- Government awareness and engagement: BKK found engaging local level government support in climate smart agriculture projects challenging.
- Reduced barriers to climate finance: BKK experimenting with approaches to accessing carbon credits for community resilience but unclear whether GSMA grant contributed
- Access to services and utilities: NA
- Individual, community or household resilience: 30,000 new subscribers a =month some of whom (40,000 +) It is difficult however to assess how many of the 40,000 plus farmers cited as using advice to adapt had been able to avail of new advice on rotation and sustainable management. Nonetheless and despite some regional variation, the vast majority of farmers using those services, over 80% claim to be using them to adapt and change.⁴⁹⁸

Factors helping progress:

- BKK's embeddedness in and trust by local communities enabled women's participation and community caretakers looking after equipment⁴⁹⁹
- GSMA brand association⁵⁰⁰ that has enabled the development of relationships with Zong and Jazz (MNOs)
- Strategic data sharing relationships with Zong and Jazz (MNOs) that enabled rapid expansion into rural areas⁵⁰¹ Which related to MNO interest in leverage profit opportunities relating to IVR⁵⁰²
- Willingness to try IVR and adapt in different languages for illiterate clients⁵⁰³
- the opportunities for technical assistance from international talent with experience in AI, networking and exposure to industry leaders at international events provided additional benefits to the company.
- Effective collaboration between technical and agricultural experts

Factors hindering progress

- Commercial challenges associated with finding a pricing strategy that enables poor farmers to access whole suite of services, this includes the costs of IVR testing
- Political and exchange rate instability adds to pricing challenges

Quality of evidence on technology working and GSMA contributions to outcomes: Low – two sources but nature of encounters and low base knowledge of evaluators

⁴⁹⁶ [case-study-leveraging-digital-technology-for-climate-smart-farming-in-Pakistan.pdf](#), KII Partner

⁴⁹⁷ KII Partner, PrivateSector Partnerships for Scale Learning Document

⁴⁹⁸ [case-study-leveraging-digital-technology-for-climate-smart-farming-in-Pakistan.pdf](#)

⁴⁹⁹ [case-study-leveraging-digital-technology-for-climate-smart-farming-in-Pakistan.pdf](#)

⁵⁰⁰ KII Grantee

⁵⁰¹ [case-study-leveraging-digital-technology-for-climate-smart-farming-in-Pakistan.pdf](#)

⁵⁰² KII Grantee

⁵⁰³ KII Grantee

	regarding this intervention made it difficult to determine precise contribution of GSMA versus other actors involved
Pakistan	<p>Crop 2 X – Sustainable agriculture (2024 Innovation Fund for Climate Resilience and Adaptation 2.0)</p> <p><i>Context:</i> In Pakistan, traditional agriculture practices use high volumes of water and fertilizer that damages soil and reduces yields. This is anticipated to become more of a problem due to the effects of climate change.⁵⁰⁴ Crop2X utilises Internet of Things (IoT) sensors and satellite imagery to provide farmers in Pakistan with real-time data and actionable insights, optimising crop productivity through its mobile application and providing weekly insights.⁵⁰⁵</p> <p><i>GSMA support:</i> CROP2X developed IoT-based soil probes measuring pH, soil moisture, and nutrients, along with a GIS monitoring platform, to provide farmer swith real time information on more sustainable farming practices</p> <p><i>Outcomes to which GSMA may have contributed:</i></p> <ul style="list-style-type: none"> • Business capabilities: Due diligence processes improved financial and operational systems, boosting confidence in securing further investment.⁵⁰⁶ • Partnerships: a formal agreement with Telenor promised opportunities to reach smallholder farmers who were not initially targeted.⁵⁰⁷ • Government awareness and engagement: CROP2X struggled to secure government support, which was vital for their technology to be seen as credible in areas where they lacked existing community ties. While CROP2X had relationships with government researchers, they appeared not to have engaged sufficiently with local government actors⁵⁰⁸ • Reduced barriers to climate finance: NA • Access to services and utilities: NA • Individual, community or household resilience: Early adopters, typically younger farmers familiar with smart devices, reported potential yield increases of 30% and water savings of 50%. Their feedback informed product development.⁵⁰⁹ <p><i>Factors helping progress</i></p> <ul style="list-style-type: none"> • Gender-sensitive outreach led by female extension workers was also introduced in an organisation unfamiliar with delivering gender sensitive services to engage women farmers.⁵¹⁰ • Financial management capacity supported by GSMA. <p><i>Factors hindering progress:</i></p> <ul style="list-style-type: none"> • Poor connectivity and literacy mean adoption among farmers without smart tech was slow, requiring extensive awareness efforts, workshops, and trust-building⁵¹¹ • High start-up and unanticipated costs meant their budget phasing did not align with resource needs⁵¹² • Absence of early government support To address this, CROP2X diversified communication methods, using SMS, WhatsApp, and printed reports to reach farmers⁵¹³.

⁵⁰⁴ [Crop2X | Mobile for Development](#)

⁵⁰⁵ [Crop2X | Mobile for Development](#)

⁵⁰⁶ KII Grantee

⁵⁰⁷ KII Grantee

⁵⁰⁸ KII Grantee

⁵⁰⁹ KII Grantee

⁵¹⁰ KII Grantee

⁵¹¹ KII Grantee

⁵¹² KII Grantee

⁵¹³ KII Grantee

	<p><i>Quality of evidence on technology working and GSMA contributions to outcomes</i></p> <ul style="list-style-type: none"> • Too early for outcomes • When it comes to contribution analysis CROP2X would likely have taken this path and tried to test this kind of solution anyway. While CROP2X may have pursued this solution independently, GSMA's financial support, technical guidance, and relationship brokering accelerated progress.
Pakistan	<p>Buraq Integrated Solutions – Early Warning Systems (M4H 2023 Innovation Fund for Anticipatory Humanitarian Action)</p> <p><i>Context:</i> Vulnerable communities in Gilgit-Baltistan and Chitral regions face multi-hazards including flood and snow avalanche. Incidences have increased and disaster response agencies are facing challenges coordinating communication to monitor, generate, and disseminate the warning messages to at-risk communities.⁵¹⁴ Buraq Integrated Solutions is a system integration and professional service provider works with environmental monitoring, automatic weather stations, early warning systems to address such challenges:</p> <p><i>GSMA support:</i> Buraq, funded under the M4H anticipatory resilience IF round in 2024 saw GSMA funding as an opportunity to leverage 4G and upgrade a well-established flood early warning system.⁵¹⁵ Prior to support from GSMA Buraq had shared weather information with government national disaster management agencies and communities using a siren-based system. Funding and association with GSMA's brand offered Buraq opportunities to develop new features and communication channels that would increase its visibility and scale. They have installed 14 new weather stations with the GSMA grant and aim to develop a cloud based, personalised early warning service system using 4G enabled phone sets in more sites. This aims to facilitate more sophisticated collation and analysis of weather data from various sources relating to different hazards including snow avalanches and landslides.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> GSMA had helped them develop new relationships and more robust financial and accounting systems. • <u>Partnerships:</u> unsuccessful with MNOs, improved relationship with government. Invitations to a multistakeholder forum on the use of AI for forest fire mitigation and management as well as Humanitarian Connectivity Charter convened by GSMA had enabled Buraq to network with government officials from the National Disaster Management Agency and NGOs working in the space. • <u>Government awareness and engagement:</u> NA • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> NA • <u>Individual, community or household resilience:</u> Buraq had not been implementing long enough to have recorded outcomes in mitigating disaster risks <p><i>Factors that helped progress:</i></p> <ul style="list-style-type: none"> • Relationships and connections supported by GSMA <p><i>Factors that hindered</i></p> <ul style="list-style-type: none"> • Commercial viability: Nature of solution that was not of sufficient scale to be of interest to MNOs
Philippines	<p>Komunidad Early Warning System (2022 Innovation Fund for Climate Resilience and Adaptation)⁵¹⁶</p>

⁵¹⁴ [Buraq Integrated Solutions | Mobile for Development](#)

⁵¹⁵ KII partner

⁵¹⁶ All analysis based on this case on advice of GSMA staff [Leveraging-Climate-Data-Analytics-for-Typhoon-Early-Warning_Komunidad_2024.pdf](#)

	<p><i>Context:</i> The Philippines has always been at risk of serious hazards and these are getting more severe with climate change. Siargao is particularly at risk. Although the Philippines has a well-established system for Disaster Risk Reduction Management (DRRM) there are opportunities to improve these through increased use of technology. Dissemination of early warning information through better government and community access and use of tech tools has been identified as an area that might improve critical decisions about disaster preparedness.</p> <p><i>GSMA support:</i> Komunidad is a Software-as-a-Service (Saas) company specialising in weather and environmental intelligence. It helps businesses, local governments and communities plan for safety, operational efficiency, and continuity during natural disasters increasingly caused by environmental destruction and climate change. Komunidad transforms environmental, weather and climate data into dashboards and reports tailored to customers' needs. Support from GSMA November 2022 to April 2024. Enabled Kominudad to provide the NDMO in Siragao with access to a data-driven EWS in the form of a web app dashboard, mobile app, SMS alerts and a public web app.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • <u>Business capabilities:</u> Komunidad attracted \$500,000 in investment during the grant • <u>Partnerships:</u> Komunidad formed a relationship with Globe Telecom and • <u>Government awareness and engagement:</u> Younger Staff of the National Development Management Office in Siargao reported improvements of institutional anticipatory and adaptive capacity resulting from improved EWS dashboard features, public website and SMS services supported by Komunidad. • <u>Reduced barriers to climate finance:</u> NA • <u>Access to services and utilities:</u> NA • <u>Individual, community or household resilience:</u> Not tested during the grant <p><i>Factors that helped progress:</i></p> <ul style="list-style-type: none"> • Effective training • Marketing campaign that increased visits to website no information on why these were implemented before it was live and possible downside of this <p><i>Factors that hindered progress:</i></p> <ul style="list-style-type: none"> • Grant timeframe meant it was not possible to test the system with beneficiaries • Older NDMO staff less likely to change behaviours and they were likely to stick to more traditional communication mechanisms to share news on hazards • NDMO budgets too low to pay for entire systems <p><i>Quality of evidence on technology working and GSMA contributions to outcomes</i></p> <ul style="list-style-type: none"> • No significant outcomes reported • Evidence on insights adequate and assumed contribution of GSMA to MNO relationship
Sierra Leone	<p>Freetown Waste Transformers (FWT)</p> <p><i>Context:</i> <u>76% of the population having no access to electricity</u> leading to mass use of diesel generators, especially among MSMEs. The waste management infrastructure in Freetown is also beset with inefficient collection processes with much being disposed of unsafely. Freetown Waste Transformers (FWT) aims to improve waste disposal management and at the same time enable access to clean and affordable energy. In 2021 they received a GSMA grant to tackle two pressing challenges in Sierra Leone's capital: inadequate waste management and limited access to clean, affordable energy. With 76% of Sierra Leone's population lacking</p>

electricity, many micro, small and medium enterprises (MSMEs) rely on polluting diesel generators. At the same time, only about 30% of Freetown's waste is safely disposed of, with the rest ending up in illegal dumpsites or the ocean.

GSMA support The grant aimed to digitalise and improve waste collection by enabling FWT to develop the DortiBox mobile app—a GPS-enabled mapping and coordination tool and implement it in partnership with the Freetown City Council. DortiBox allows waste collectors to track, manage and report organic waste collection in real time, helping FWT secure the feedstock needed for its anaerobic biodigesters. These biodigesters convert organic waste into biogas for electricity generation, providing a sustainable alternative to diesel power. FWT also secured strategic partnerships to scale impact. Collaborations with Africell Sierra Leone and Orange Money Sierra Leone enabled mobile money integration within the DortiBox app, facilitating cashless transactions. Africell further became an energy offtaker, directly purchasing electricity generated by FWT units

Outcomes to which GSMA may have contributed

- **Business capabilities:** increased but narrow financing model
- **Partnerships:** FWT developed strong partnerships with the Waste Collection Management Association and Freetown City Council, which established an enabling environment for their model. This has deepened and expanded through a Public Private Partnership to incorporate the DortiBox app across the city.⁵¹⁷ FWT partnered with Africell Sierra Leone and Orange Money Sierra Leone to enable mobile money transactions, however low mobile penetration, and a risk of mobile money fraud posed challenges to scaling⁵¹⁸. Africell further deepened its collaboration with FWT by taking some of the energy produced by the waste transformer units. Freetown Waste Transformers attracted an additional £3m⁵¹⁹
- **Government awareness and engagement:** Freetown City Council engaged with Freetown Waste Transformers and endorsed their app as the approach contributed to achieving the City's waste management targets⁵²⁰. They recently awarded FWT a contract⁵²¹.
- **Reduced barriers to climate finance**
- **Access to services and utilities:** Freetown Waste Transformers (FWT) diverted significant volumes of organic waste from landfills to clean energy through their waste-to-energy solution mitigating climate change. Over 45,000 residents are reported to benefit through timely household waste collections, increased revenue or electricity provision.
- **Individual, community or household resilience:** NA (indirectly through employment)

Factors that helped progress

- Strategic partnerships with key players such as the City Council supported scaling. The city will leverage the DortiBox app, mandating all households to sign up for automatic collections and make payments through the app. FWT has also been working with the Waste Collectors Management Association, which brings together waste collectors and has become a voice for its members, and has already trained and onboarded them onto the app.
- The app educates and raises household awareness on waste collection and best practices. The majority of DortiBox users noted that the app helped them.

⁵¹⁷ <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/freetown-waste-transformers-ftw-secures-major-waste-collection-concession-from-freetown-city-council/>

⁵¹⁸ [Digitising waste collection: Freetown Waste Transformers' DortiBox app in Sierra Leone | Mobile for Development: An analysis of the Potential Risks and Frauds involved in Mobile Money Transaction in Freetown Sierra Leone, A Case Study Of: Orange and Africell Mobile Telecommunication Company in Freetown, Sierra Leone. – IJERT GS](#)

⁵¹⁹ GSMA M4D Donor reporting KII spreadsheets

⁵²⁰ [ODI working paper](#)

⁵²¹ <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/freetown-waste-transformers-ftw-secures-major-waste-collection-concession-from-freetown-city-council/>

	<p><i>Factors that hindered progress</i></p> <ul style="list-style-type: none"> • Low penetration of device ownership and low trust of mobile money.⁵²² Most waste collectors did not have smartphones and the number of women waste collectors with mobile devices was even lower.⁵²³The new features such as USSD code for users with analog devices and voice assistance for non-literate users will make it easier for more households to access the application and request essential waste collection services across the city. <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none"> • Very good there is considerable evidence on the overall success of FWT including independent evidence on the significance of the GSMA grant.
Somaliland	<p>Dayaxa – sustainable Frankincense harvesting 2022 Innovation Fund for Climate Resilience and Adaptation⁵²⁴</p> <p><i>Context:</i> Somaliland’s faces worsening droughts, floods, and erratic rainfall, harming pastoral livelihoods and driving a shift to agropastoralism. Somaliland is a major global exporter of frankincense from native <i>Boswellia sacra</i> and <i>B. frereana</i> trees, prized for their aroma and medicinal uses. Over 1,000 tonnes are exported annually, but the traders faces severe challenges: insecurity and restricted market access due to political instability; land disputes under informal tenure systems; unsustainable tapping practices that risk forest loss; climate change and insect infestations; and a lack of monitoring or reforestation initiatives.</p> <p>Market demand fluctuates and intermediary-dominated supply chains lack transparency, leading to overharvesting, exploitation, and unfair pricing. Harvesters often sell resin at low, arbitrary prices—sometimes paid late, in kind, or not at all. Poor working conditions, especially for women, have been reported. Increasing global demand for ethical sourcing adds pressure for traceability and sustainable management to secure both livelihoods and the long-term survival of Somaliland’s frankincense forests.</p> <p>The Dayaxa Frankincense Export Company (DFEC) addresses challenges faced by frankincense harvesters, including a lack of fair market access and knowledge of sustainable practices. It closely with local frankincense communities to address both issues</p> <p><i>GSMA support:</i> DFEC in the development of an online platform using blockchain and a mobile app to make the frankincense supply chain in Somaliland digitally traceable. This was to provide harvesters with more control over pricing, while reducing pressure to overharvest, improving the sustainability of frankincense resin.</p> <p><i>Outcomes to which GSMA may have contributed</i></p> <ul style="list-style-type: none"> • Business capabilities: The process derisked producers for buyers and led to a lucrative contract with lush • Partnerships: NA • Government awareness and engagement: NA • Reduced barriers to climate finance: NA • Access to services and utilities: NA • Individual, community or household resilience: 1380 Individual traders reported improved prices, more predictable incomes and the mapping of 2800 vulnerable <i>Boswellia</i> trees but whether this would reduce overharvesting was uncertain

⁵²² [An analysis of the Potential Risks and Frauds involved in Mobile Money Transaction in Freetown Sierra Leone, A Case Study Of: Orange and Africell Mobile Telecommunication Company in Freetown, Sierra Leone. – IJERT GS](#)

⁵²³ [Sierra Leone: Selected Issues in: IMF Staff Country Reports Volume 2022 Issue 260 \(2022\)](#)

⁵²⁴ All content taken from draft of case on advice from GSMA staff [Dayaxa Frankincense: Blockchain for supply chain transparency | Mobile for Development](#)

	<p><i>Factors that helped progress:</i></p> <ul style="list-style-type: none">• Blockchain effectively de risked purchases for international buyers and speeded up payments• Technology enabled monitoring of Bosweillia health <p><i>Factors that hindered progress:</i></p> <ul style="list-style-type: none">• Connectivity challenges and software was difficult to implement• Low trust between buyers and sellers in a slow moving industry meant contracts took time to secure• Even though harvesters understand the theoretical benefits, they may not have the adaptive capacity to change behaviours and adopt more sustainable harvesting practice• Security situation made workshops and set up of tree nursery challenging as well as GSMA visits challenging <p><i>Quality of evidence on technology working and GSMA contributions to outcomes:</i></p> <ul style="list-style-type: none">• Suggestions of technology improving trust and increased incomes are promising however they need to be triangulated. Many of the challenges mentioned suggest incomes may not be sufficient to increase adaptive capacities to the extent that they reduce pressures for unsustainable practices. <p>With no mention of leveraging MNOs, this is an example where it is more difficult to identify GSMA's contribution beyond money. It was a very difficult context in which to provide support</p>
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Annexe 10: Applying GSMA strategic role & ecosystems approach to climate sectors/issues

Drawing on the evidence and analysis presented thus far, we apply the proposed strategic considerations and positioning of GSMA to several areas of the M4D climate portfolio, namely climate finance, agriculture and urban utilities.

Climate finance and carbon credit markets

There is strong evidence that the quantity and effectiveness of climate finance (both public and private) is insufficient to drive the climate mitigation and adaptation actions needed. Moreover, very little climate finance reaches vulnerable communities and households. There are calls for new approaches to climate finance at all levels, including more participatory and accountable mechanisms, leveraging both technology (e.g. blockchain and mobile money) and a diverse set of actors referred to as an 'accountability ecosystem'. This is particularly true for private climate finance. According to the evidence presented in EQ1, there are challenges in terms of the alignment of mechanisms to generate private investment and the principles of inclusive and effective climate adaptation and resilience building, suggesting that the governance of private sector financing must be more transparent, decentralised, collaborative and accountable to those whose lives are impacted.

According to the broader evidence, the complexity in calculating carbon offset credits and the incentive to overestimate in order to maximise economic returns has significantly undermined the potential and actual impacts of for mitigation, with many evaluations of carbon offsets finding that the vast majority were subject to over-estimations and/or weak justification that they would not have been undertaken anyway (lack of 'additionality'). This has led to hundreds of millions of tons of greenhouse gas emissions that were paid for with carbon offsets not having been offset in reality, thus contributing to climate change. In addition to the carbon offsetting mechanisms set up by global climate agreements, voluntary carbon offset markets are growing in popularity. The evidence also suggests that voluntary carbon markets face challenges in their market mechanisms (complexity, risk, quality, and resource issues) and integrity (opacity, double counting, lack of additionality or proper safeguards, potential for greenwashing).

For relatively less complex scenarios, an intermediary leveraging appropriate technology can facilitate climate finance reaching vulnerable households. As findings in EQ2 suggest, ATEC's model of ensuring that carbon credits are transparently and accountably used to reduce carbon emissions through the provision and monitoring of efficient stoves (equipped with IoT) is a good example of this. This enabled more transparent and credible data to carbon market investors and facilitating access and use by households. Even with this relatively straightforward case, some questions arise, including whether the need for reliable electrical connection (lacking in some informal communities and more so in rural areas), upfront cost (despite significant subsidy), smartphone access and know-how (despite significant client support from ATEC), might have some impacts on the degree to which the e-stoves are accessed by poorer households. The incentive to cook more to access more carbon credits might partially diminish the overall climate mitigation benefit, particularly depending on the source of electricity in each community (for example, Bangladesh's energy mix is largely fossil fuel-based). Finally, while this approach does connect carbon credits to end users with a dual benefit for people and climate, the standalone nature of the product raises questions about whether there would be even more gains by pairing it with expansion of solar energy (potentially learning from the example of Koolboks), leveraging ATEC's bridging role in the carbon market. This could be a potential future direction in partnership with an organisation providing solar power; this could be even more important for expansion of the e-stoves into rural areas, along with pay-as-you-go to further enable access by cash-poor households.

Nature-based solutions, particularly forest preservation like those undertaken by Safaricom, J-Palm and Dayaxa (EQ2), have also been championed as carbon offset projects. However, the evidence suggests that these face significant limitations as well, such as shifting deforestation to other non-protected forests, protected forests being destroyed by forest fires or other disasters, and the diminished carbon sequestering capacity of forests due to climate changes such as drought and extreme heat. Carbon offsets for conservation build on decades of Northern-financed efforts, which have contributed to the commodification of nature in the global South. There is evidence of detrimental impacts to local indigenous peoples and communities (including but not limited to land grabbing).

Mobile and digital technologies have potential to address some of the challenges in climate finance, such as carbon markets and payment for ecosystem services (PES). The evidence points to strengthening more transparent and accountable verification of mitigation and/or adaptation actions and impacts, while enabling direct payment to front-line actors. However, in some contexts, this will face resistance from actors benefiting from a more opaque and informal status.

Institutions like the United Nations Environment Programme have also pointed to the potential of technologies such as blockchain that have been trialled by several GSMA grantees. However, other experts note that blockchain may only offer incremental improvements over other approaches, and does not address the main challenges to climate finance, adaptation or mitigation, indeed driving up carbon emissions due to its energy-intensive processes. A case study from Peru discussed in the literature review suggests that community forest monitors do find smartphones to be a useful tool, but that multiple individual, community and institutional factors play a role in the effectiveness of this climate finance mechanism. GSMA's own projects (J-Palm and Dayaxa) and insights on mobile digital for sustainable NRM points to the need to understand and address structural, technological, social and behavioural factors and constraints.⁵²⁵

In the case of 4R Digital's CaVEx platform, the approach brings together important stakeholders, including the carbon credit buyers, the Government of Kenya, Safaricom, M-PESA, and community forestry associations, among others. Similar to ATEC, the CaVEx platform leverages digital technologies to facilitate data generation and transparency that increased the confidence of climate credit buyers, while enabling forestry association members to receive payments directly for their reforestation activities (with some share of credits going to other actors, like the government and Safaricom). However, the challenges of carbon market volatility, government regulation, vested interests, and community engagement and livelihood needs all suggest a complex system of actors, relationships, incentives, etc. as is emphasised in the broader evidence. There are some questions of exactly how the access to carbon credits could impact community forest associations, their members, and other community stakeholders, particularly whether shifting incentives with respect to opportunities and burdens creates unforeseen consequences. Influential community members could gain more control over carbon credits while safeguarding their agricultural land, while others might see their livelihoods diminished without adequate compensation from carbon credits. These kinds of local power dynamics and inequalities generated by carbon markets and PES have been highlighted in the broader evidence base, which often reports mixed results from such initiatives, particularly when local governance and community engagement are not sufficiently inclusive and accountable. The tools and approach demonstrated in the World Vision Kenya project could offer some potential to address some of these issues.

Overall, the evidence base and examples from GSMA's partners (EQ2) demonstrate both the promise and challenge of leveraging mobile digital technology for equitable and accountable climate finance. Technology can generate, aggregate and share data, as well as transferring financial resources, more effectively and at scale. This opens up opportunities for reaching broader populations – a significant challenge in most current climate finance efforts. However, there are numerous factors to take into account in ensuring inclusive and effective access, use and impact

⁵²⁵ Exploring barriers and incentives to digital solutions in natural resources management. 2023.

given the complexity of local, national and international systems. GSMA could play more of a role in scanning and assessing these complex systems, and thinking through issues of inclusiveness, impact and sustainability from the start and/or connecting to other actors that are already doing this (e.g. international actors, donors and donor funded initiatives working on similar issues).

GSMA has already played an important role in generating evidence on the potential for advocacy (EQ2), therefore its convening and connecting role is also critical in this regard. But it could go further by identifying other potential linkages and funding a set of complementary organisations and projects to collaborate on a more inclusive, holistic and multidimensional approach. In the case of ATEC, that might include linking to decentralised renewable production or other actors/efforts that could provide synergies with the eCooking carbon credit platform. GSMA could also consider whether it could facilitate bringing representative citizen groups (particularly larger associations or federations) and/or CSOs that work closely with target populations into the project discussions early on to co-create design and facilitate community engagement throughout.

In the case of 4R Digital, several important actors were already collaborating, but there are potential gaps at the level of local governance, particularly as additional resources begin to flow to forestry associations. As noted above, the approach demonstrated by World Vision Kenya's Tana River project could offer both lessons and potential for collaboration. Elements of that approach to gathering input from communities and integrating conservation into local development plans could bring greater inclusiveness and structure to the Safaricom reforestation efforts. Conversely, the CaVEx platform could allow World Vision Kenya to finance more conservation efforts in a way that ensures greater inclusiveness and accountability, as highlighted in the broader literature.

GSMA could play a significant role in scoping and facilitating such a collaboration. Its work in connecting Safaricom to 4R Digital and World Vision Kenya could be leveraged to explore bringing these initiatives into discussion and potential partnership. GSMA's evidence and insights on leveraging mobile digital technology for carbon markets could continue to guide this multi-stakeholder process alongside World Vision Kenya's expertise in inclusive local governance of conservation.

Furthermore, GSMA could maintain its involvement for longer, with a focus on enabling collective learning and adaptation through the engaged approach (EQ2), as well as to promote sustainability and impact. As noted above, often GSMA lacks information about impacts and sustainability of work that it has supported at an earlier phase of development. From a value-for-money perspective, when GSMA has made significant upfront investments of resources, staff time, etc., then it makes sense to continue some level of involvement that could enhance the possibility of more sustained impact and/or help GSMA understand why impact and/or sustainability fell short of initial expectations, incorporating these lessons into its approaches and sharing with the broader community.

Agritech, mobile money and other financial services

As outlined in EQ1 and above, climate change adaptation and resilience frameworks and approaches need to be informed by a nuanced analysis of the vulnerabilities of individuals, communities and groups. As emphasised in the broader evidence, approaches that seek to strengthen adaptive capacities and resilience that go beyond isolated, incremental and potentially maladaptive changes must identify and address the root causes of climate change vulnerability at the ecological, social, economic, and political levels. This includes the power asymmetries that cause or exacerbate the vulnerabilities of socially marginalised groups. The evidence discussed in EQ1 emphasises that many initiatives seeking to strengthen adaptive capacity and resilience fail to do so meaningfully, often due to one or more of the following factors:

- insufficient understanding of contextual vulnerability
- inequitable participation in planning and implementation of interventions
- retrofitting adaptation into existing programmes or assistance

- insufficient conceptualisation and evaluation of successful outcomes for adaptation.

As highlighted in EQ1, more inclusive, holistic and systemic approaches are best placed to go beyond these weaknesses and contribute – in combination and over the long term – to more transformational adaptation and resilience. The evidence highlights two particularly promising areas: (1) strengthening cooperative associations that can engage in diverse and synergist adaptation approaches; and (2) holistic agroecology-based adaptive approaches.

Thus, the main message from the evidence on more inclusive, meaningful and sustainable climate adaptation and resilience outcomes for agricultural households and communities is about the need for holistic, multidimensional and flexible approaches that meaningfully identify and address the vulnerabilities faced by individuals, groups and communities. That means including mobile digital tools as part of a broader approach to strengthening the adaptive capacities of farmers, their households, and rural communities beyond individualised coping strategies like crop insurance or weather information. Given the importance of cooperative associations for diverse adaptation strategies and outcomes, where possible these should be identified as partners for co-creation of digital tools and approaches. Similarly, agricultural extension services are leveraging mobile communications and tools to reach and support farmers in remote locations, and can be another key stakeholder in a collaborative approach, despite their often limited resources. Finally, while mobile digital technologies are demonstrating their potential for climate-adapted agriculture, not all rural communities have access to mobile services and not all households or individuals have access to smartphones, or even mobile phones in some cases. Thus, community radio and other offline communications approaches should be considered alongside mobile digital.

As we found in EQ2, GSMA partners such as Aquarech, BKK and Lersha exhibit many of these insights, while also demonstrating the opportunity to go further in contributing to inclusive, meaningful and sustainable adaptation and resilience. All three organisations provide a package of services to agri/aquacultural producers, generally focusing on information and advisory services, which surveyed farmers have generally found helpful in informing adaptations. The organisations also provide access to financial services and access to markets (Lersha and Aquarech). In all cases, a majority of users were accessing free or low-cost services, while a minority were paying for premium features.

These agritech service providers demonstrate the opportunities and limitations of the commercially viable impact pathway discussed earlier (Annexe 11). They have the potential to reach very significant scale, with a financially sustainable business model that can subsidise some level of service to lower-income users ('freemium' model), including those without access to mobile digital technology. However, the accessibility and impact of the free or lowest-cost package of support is limited relative to the vulnerabilities of the poorest of agricultural producers and households. There is little explicit evidence of analysis having been done of the climate change vulnerabilities of agricultural and aquacultural producers as part of GSMA's engagement and support. Users have noted that they lack the economic resources to implement the advice they have received.

BKK is trying to go further in accessing commercial and non-commercial finance to further subsidise and complement its core freemium model. However, as discussed below, this is far from straightforward and may entail unforeseen and potentially negative consequences for BKK's users.

All three organisations could benefit from engaging with a broader ecosystem of climate actors in their space to seek additional synergies and complementarities, potentially bridging into the combined commercial/non-commercial impact pathway (Annexe 11). This could include public actors, like agricultural extension offices and local governments, as well as groups representing smallholder farmers and fish producers. The latter are emphasised in the evidence as being important actors for more holistic adaptive strategies. They can leverage their membership to scale innovations, pool resources, co-create solutions, and influence government policies. GSMA could continue and strengthen its role in analysing and connecting actors and efforts across these broader

ecosystems to enable more holistic and inclusive agricultural adaptation approaches, both leveraging and complementing mobile digital technologies and services.

Finally, the evidence also points to the importance of more holistic adaptations, like agroecological approaches. It is unclear whether the climate-smart support services offered by these organisations are fully aligned or contributing to more resilient, regenerative agroecological practices or systems. Nonetheless the important work that GSMA has already started on supporting partners with environmental assessments could be expanded further and used to encourage such approaches.⁵²⁶ Bringing together public, private and civic actors and efforts could enable exploration of coordinated and complementary approaches supporting the incorporation of agroecology for vulnerable producers and communities. GSMA's connecting and convening role could be leveraged to this end. These collaborations could potentially tap into carbon markets that support such approaches, both for climate change mitigation and resilience. GSMA could draw lessons from partners who are leveraging mobile digital to support agroecological approaches, such as CROP2X in Pakistan, and share these more broadly, potentially including them as a criterion for partnership selection and grant support.

Agritech companies are increasingly including financial services as part of their offering, and in some contexts, leveraging the spread of mobile money. In a country like Kenya, mobile money has become ubiquitous and transformative. It has also enabled other services and access to financial products, such as insurance and loans. The evidence in Kenya suggests broadly positive outcomes thus far, including for savings and earnings. However, to the extent that mobile money is increasingly facilitating access to loans for smallholder farmers, it is important to consider evidence and lessons from previous experiences of the boom in micro-credit. In some cases, this led to unforeseen negative outcomes, including asset price bubbles and increasing household debt.

The ubiquity of mobile money in a context like Kenya may also obscure some degree of exclusion, such as the very poorest households who may not have a mobile phone or where a family owns a single mobile that is controlled by the head of the household, potentially introducing gender or other dynamics into access and use of mobile money. Wherever mobile money is used to ensure that resources reach populations impacted by climate shocks, it is important to consider that the most vulnerable, including within households, may be those with the most limited access to mobile money.

On the other hand, the large-scale use of mobile money (as well as digital engagement more broadly) can entail the generation and sharing of significant amounts of data from users, with limited transparency on how it will be used. AI and algorithmic decision-making based on big data generated by users of mobile money is unlikely to be transparent-by-default, thus raising questions about who might be advantaged or disadvantaged by any biases or opaque decision-making criteria. Privacy and data protection is a broader consideration for mobile digital technologies in which users are potentially sharing significant personal information without full knowledge (or necessarily consent) about how it is used. Increasing use of biometrics and geolocation could also raise issues of surveillance, including by governments who might wish to access such information.

Finally, it is important to understand the political economy of mobile money. In Kenya, Safaricom has close links to a broad spectrum of political elites, including as shareholders receiving generous dividends, which have put in place friendly regulation that enabled the growth of M-PESA without major competition until more recently. Across Africa, mobile money displays monopolistic tendencies, with major players seeking to keep out new entrants to keep their profits high.

These considerations are also relevant to other contexts. In the case of Pakistan, BKK's large user base and its increasing incorporation of financial services through its platform, along with 'de-risking'

⁵²⁶ [Five steps to measuring environmental impact of climate tech innovation | Mobile for Development](#)

engagement by other financial service providers by leveraging the data it collects from farmers, raises many of the above questions of privacy and potential unforeseen consequences as well.

In countries where mobile money is increasingly being leveraged by agritech service providers (as well as other partners), GSMA could include considerations of data privacy and transparency around the use of such data more explicitly in its engagements with MNOs and other actors in the mobile ecosystem. This could help protect vulnerable groups from potentially unforeseen negative impacts of their data being extracted and used through their engagement with mobile money and other mobile digital applications. GSMA could collaborate with partners like BKK and Lersha to innovate ways to provide financial services to low-income farmers while addressing privacy and security issues. GSMA could help share these insights more broadly in the Agri Tech and Financial Inclusion space.

Urban utilities

GSMA's digital utilities work is informed by important insights about the increasing vulnerabilities and services divide in rapidly growing informal settlements in large and intermediate cities across LMICs. The broader evidence on informal communities emphasises both the structural challenges faced by these communities (physical, socioeconomic and political) and the micro-adaptations made by households. Evidence from the literature review demonstrates that the approximately 1 billion urban informal settlement dwellers are particularly vulnerable to climate change, including floods and heat, due to their physical location (often along ravines or other significantly sloping terrain), lack of basic services, and the socioeconomic characteristics of most residents that leaves them with comparatively little individual and collective adaptive capacities. Informal settlement communities are often not the highest priority for city decision-makers (as significant evidence on the political economy of urban poverty makes clear), though there are numerous examples of community-based organisations and federations at the city and national levels that are able to negotiate more successfully with city leaders as well as mobilise resources from their members to improve informal settlements, which could be leveraged to enhance climate resilience as well. Some promising evidence points to 'co-production' of services between informal communities and government to make best use of scarce resources and minimise further exclusion.

Efforts like Freetown Waste Transformers, Taki ni Ajira's Zaidi app, and Taka ni Mali's collaboration with Safaricom to expand the Ecoloop platform seem relatively aligned with this approach by complementing and strengthening existing systems and practices for service delivery with mobile digital technology, including the livelihoods of workers who collect and/or sort waste. However, it is not clear to what extent these efforts have improved solid waste services, particularly in peri-urban/informal settlements where service gap is the greatest. A similar effort in Lahore, Pakistan, was less successful in getting off the ground, due to design and contextual challenges. Several Digital Utilities grantees (including Wonderkid in Kenya) seem to work on the assumption that using digital technology to improve the efficiency of service providers will result in expanded, improved and/or climate resilient services, including to under-served groups. However, as noted already, there is currently no clear evidence to support this claim.

GSMA rightly emphasises the importance of engaging and aligning with the public sector to ensure an enabling environment and coordinated approach. As we see in EQ2, GSMA's Digital Urban Utilities Forums and other spaces seem to play a very important convening role to enable more productive partnerships for resilient services at sectoral scale. However, the forums could be more inclusive of groups representing and/or working with the informal communities and populations that these stakeholders are seeking to reach. The evidence suggests that many urban governments in LMICs fail to meaningfully engage citizens from informal settlements, thus GSMA could play an important role in incentivising inclusiveness. This has been a promising approach followed by other urban resilience programmes assessed in the broader evidence base, as well as being suggested by GSMA's own research pointing to the importance of co-creating solutions with vulnerable

communities.⁵²⁷ The engagement with Kenya Alliance of Resident Associations seems like a positive step in this direction, though it is not clear what kinds of urban communities this organisation represents, particularly peri-urban and informal settlements. Nairobi, like many cities across LMICs, has representative groups and urban coalitions working toward inclusive and resilient public services, which GSMA and its partners could connect and align with.⁵²⁸

Finally, the broader evidence on urban resilience emphasises the need to be learning-focused and adaptive, particularly enabling collective learning across relevant stakeholders. There are roles for both convening multi-stakeholder learning (above) and mobile technologies, the latter of which can help generate and share data for adaptive decision-making about addressing climate change vulnerabilities. This could also enable better alignment of efforts and resources with the most pressing climate vulnerabilities of informal settlements, while generating data and shared understanding of the causes of these vulnerabilities and constraints on addressing them, thus enabling collective action towards holistic solutions enabled by mobile digital technologies.

This approach could be applied by GSMA to strengthen the role of mobile digital technologies for urban disaster resilience as well as for more resilient urban service systems. In the latter case, GSMA could support partners such as Wonderkid to go beyond using mobile digital to make water systems more efficient towards more explicitly and inclusively addressing climate vulnerabilities in water systems and collaborating with representative stakeholders, including government and informal settlements, towards more systemic solutions. The same approach could apply more intentionally and consistently in the work on solid waste management. With reference to the impact pathways discussed earlier, this would likely entail either more explicitly aligning commercially viable digital utilities approaches with more inclusive and systemic service delivery strategies or exploring combined approaches through public–private partnerships that bring together private investments and revenue streams with public financing for more holistic solutions. As the evidence of co-production suggests, urban residents themselves are active in developing ‘best fit’ solutions given their resources and circumstances, and their efforts could be more intentionally brought into these holistic service delivery approaches.

As discussed, these considerations broadly align with GSMA’s approach to digital utilities. The principal shifts would be a strategic pivot to a more holistic and systematic approach to inclusive, resilient and efficient urban services, and an even greater emphasis on assessing, convening and co-creating with a representative urban services ecosystem of actors and initiatives to seek greater alignment and complementarities. Continued engagement in a defined set of urban ecosystems would allow GSMA to play a greater role in supporting and strengthening these collaborative arrangements, including tracking, assessing and learning about progress towards (and challenges encountered) meaningful, inclusive and sustainable climate change outcomes.

⁵²⁷ See also: Faldi, G., Ranzato, M. and Moretto, L. (2022) Urban service co-production and technology: nine key issues. *International Journal of Urban Sustainable Development* 14(1): 146–161. <https://doi.org/10.1080/19463138.2022.2060237>

⁵²⁸ A potentially useful resource on inclusive urban governance, reform and service improvement is <https://www.african-cities.org/> another example from cities across South Africa is <https://asivikelane.org/>

Annexe 11: Review of GSMA insight outputs

The evaluation team have engaged with many of the different M4D and M4H insight reports, case studies and blog posts as part of our overall evaluation. We also conducted a specific review of the programmes' climate-related outputs to assess quality across the portfolio.

We took a sample of three insight reports; 1 Innovation Fund cohort report; 3 Innovation Fund grantee case studies; 3 blog posts, and 1 of each of a number of other types.⁵²⁹ Each output was reviewed according to the following criteria:

- **Clarity/readability:** How clear and readable is the report? Is the purpose, analysis, discussion and conclusions/recommendations clear? Is the language used appropriate for the intended audience?
- **Visuals:** How effectively are visualisations/diagrams used in the report? Do they clearly convey data/information?
- **Significance/uniqueness:** How significant is the topic covered? How unique is the information/evidence produced/shared?
- **Quality of evidence:** What is the quality of evidence in the report given its intended purpose?
- **Potential utility:** How likely is the report likely to be of use for intended users? Does the report provide sufficient insight to be actionable?

Eight of the 11 outputs reviewed were considered high quality, 3 were considered medium quality.

Output type	Notes	Quality
High level landscaping reports	Really clear and well written reports which are easy to scan and identify interesting points. Good use of infographics to break up text and convey information. Sometimes recommendations feel very general and decontextualized. In some reports, content regarding an innovation round relevant to the theme appears dropped in but not really clearly explained why it is there. Reports tend to use double column design which creates irritating usability issue ⁵³⁰ .	High
More focused report building off a landscaping report focused on a country/use case/technology.	Really clear and well written. Good use of infographics. Specific focus may help usability.	High
Innovation call analysis reports	Interesting analysis but unclear who the audience is for a product like this. Investors? Donors? Academics? Potential ethical issues regarding creating a product off the back of substantial resources put in by unsuccessful applicants.	High

⁵²⁹ Other output types included the Glossary, grantee video clips, and the website.

⁵³⁰ Large proportion of people will read GSMA reports on digital devices - for many, the print double column layout means scrolling down, back up the page and down the second column.

Output type	Notes	Quality
Portfolio introductions	Useful communication piece to illustrate the range of what GSMA IF is funding.	High
Case studies - analysis of individual grantees	Clearly written case studies to provide substantive information on what grantees did and achieved. Many are unclear about the evidence upon which claims are made or what statistics actually represent. The cases contain “lessons” but it is unclear whether these are the grantee’s lessons or lessons generated by GSMA’s analysis.	Medium
Case studies - blog posts	Clearly written case studies to provide information on what grantees did and achieved. Many are unclear about the evidence upon which claims are made or what statistics actually represent. The cases contain “lessons” but it is unclear whether these are the grantee’s lessons or lessons generated by GSMA’s analysis.	Medium
Green glossary	Really clear and useful output to help to bring clarity to a field that is jargon heavy and contested. Useful to know how GSMA defines different terms and concepts - particularly for individuals and organisations who are less familiar with the climate field.	High
Blog posts on particular programmatic initiatives	Clear and well written. Valuable means of providing information and visibility to some of the really interesting non-grant programmatic initiatives/partnerships. Some posts are unclear as to how work is linked to a clear strategy or thread of GSMA’s work.	High/medium
Blogs round up of portfolio of non-grant work	Clear and well written.	High
Short video pieces - intro to grantee; Grantee summary pages mapping out the problem, the company, the solution and any impact; “Meet the founders” video clips	Clear and well produced. These pages are useful but don’t look they are regularly updated as the grant progresses and case study reports are available	High
Website	Landing pages appear clear and well structured. A few broken/incorrect links. Lower level pages: e.g. blog post ,full report templates are a bit basic and waste a lot of space Actual content often doesn’t start until below the fold of the page. Would more usable to see more useful meta-data e.g. Title, Document publication data,	Medium

Output type	Notes	Quality
	Authors, Keywords, description/abstract without scrolling. Would be useful to see related resources to the publication/blog post/grantee profile.	

Annexe 12: Analysis of GSMA Climate Tech theory of change

This annexe presents an analysis of the GSMA Climate Tech theory of change (ToC), drawing from the Climate Impact Narrative, Climate Tech programme theory of change, and analysis of GSMA programming. The analysis focuses on the problem analysis and assumptions, the latter being general implicit in the ToC documents.

Problem analysis and evidence relating to the problem analysis

The problem analysis underpinning the M4D climate portfolio (reflected in the Impact Narrative and Climate Tech ToC) reflects the programmatic approaches and technological solutions that GSMA is most focused on, rather than the climate change impacts that the organisation seeks to achieve. Significant gaps exist around the articulation and analysis of the main drivers of climate change vulnerability of target populations; the barriers to access, use and impact of mobile technologies for climate action; and the broader systems, governance and political economy factors related to the climate outcomes GSMA is working towards. Thus, the problem analysis fails to provide a holistic, systematic identification, assessment and understanding of the core problems that GSMA and its partners are working to address.

The Climate Tech Impact Narrative sets out an array of problem statements related to the M4D and M4H programmes working towards climate change outcomes across mitigation, adaptation and natural resource management. The problem analysis is organised around GSMA M4D's climate portfolio and the approaches and technological solutions they are seeking to leverage. Generally, the problem analysis appears to reflect existing programming approaches, rather than having been undertaken independently to inform those approaches. Thus, there are implicit assumptions that approaches and technologies being promoted by GSMA programmes address the major gaps or challenges faced by vulnerable households and communities, as well as governments, without clearly articulating why this is the case. For example, there is a strong emphasis in the problem analysis on gaps in awareness and information. This aligns with the findings in the broader evidence presented in EQ1 on the uses of mobile digital technologies for climate outcomes, but the broader evidence (including from GSMA's analysis and learning) suggests numerous other barriers and constraints beyond awareness and information.

Furthermore, the problem analysis is fragmented across diverse areas of programming and climate action, without identifying and assessing the core challenges related to the overall climate outcomes GSMA is working toward. For example, GSMA is working toward the long-term impact of more climate-resilient and adaptable households and communities. However, the broader evidence from EQ1 on climate change adaptation and resilience highlights the diverse drivers of climate vulnerability at the levels of individuals, households, communities, localities, nations and regions. Causes of vulnerability include individual capacities, incentives and other influences on behaviour, as well as broader social, economic, political and governance factors. These include the structural issues and power dynamics that marginalise some groups, creating and/or exacerbating their climate change vulnerability. There is considerable evidence presented in the Literature Review that failing to identify and understand the diverse elements and drivers of climate vulnerability often leads to narrow, isolated and often technical approaches that do not meaningfully or sustainably strengthen climate resilience; often leading to shorter-term 'coping' adaptations or unconnected incremental improvements that do not lead to more coherent and holistic capacities and strategies for resilience. Generally, there is little evidence that GSMA problem analyses at the level of portfolio, country, different themes, and/or project/partnership reflect an adequate assessment of the causes and consequences of climate change vulnerabilities of priority groups and populations, or other barriers to the outcomes GSMA is working towards.

Some GSMA analysis and learning points towards a more holistic understanding of the range of challenges to leveraging mobile digital technologies for climate change action and outcomes, including the structural/technological, social/economic/political, and individual behavioural factors that influence access, use and impact. This can be seen in insights about climate tech for

sustainable natural resources management⁵³¹ that generally align with the broader evidence. However, we see less use of this in practice. There is little evidence of contextualised problem analysis of these factors in Pakistan or Kenya having been undertaken or informing programming across country portfolios within specific programming areas, or in some cases for individual partners and grants. This includes assessment of the political economy, governance and institutional factors that shape mobile digital technologies and services, as well as climate action and outcomes more broadly. Conversely, where a contextualised set of challenges and constraints has been identified, such as in the Indonesia Mobile Innovation Hub scoping study, it is not clear how that problem analysis informed the ToC, partnerships and strategies that were undertaken (see below).

Broadly speaking, the evidence on climate change vulnerabilities, approaches and impacts summarised in EQ1 strongly points to the complex systems in which individuals, communities, governmental actors and private businesses are embedded and that shape their individual and collective incentives, behaviours, capabilities, actions and outcomes. The exploration in EQ1 confirms that this applies to the role and impact of mobile digital technologies and the actors enabling, providing and using these technologies for climate action.

The M4D Climate Impact Narrative does identify one set of relevant problems, causes and implications, but it is fragmented and biased towards existing approaches and solutions, and the assumptions that underpin these. Other existing GSMA assessment and reflections could be leveraged to complement and deepen this initial analysis, but this is not yet evident, including more contextualised insights from the countries and ecosystems where GSMA is more deeply embedded. Thus, the existing problem analysis at portfolio, programme and country levels generally fails to provide a systematic assessment and understanding of the core climate change problems that GSMA is working to address in a way that inform approaches, strategies and actions.

Finally, the broader climate change evidence presented in EQ1 suggests a wider set of actors and actions contributing to and constraining climate action and outcomes. **This suggests the need for a more robust understanding of the climate action ecosystem that includes but goes beyond actors and efforts focused on leveraging digital mobile technologies for climate action.** A broader stakeholder mapping of the climate action ecosystem would include other actors and initiatives working towards shared climate change objectives, and the potential to complement and/or integrate mobile digital technologies with these efforts. This would enable GSMA and its core partners to understand and engage others working towards shared outcomes and the opportunities to explore complementarities that would maximise the contribution of mobile digital technologies to climate change outcomes and impacts.

Assumptions and evidence relating to the assumptions

Below we articulate 6 implicit assumptions in the GSMA M4D Climate Portfolio based on the Impact Narrative, ToC, and other programme documents, as well as discussions with GSMA staff.

1. Assumption that the uses of mobile digital technology by and for vulnerable groups to achieve inclusive, meaningful and sustainable climate change outcomes are those that are also commercially viable and scalable by MNOs and other businesses.

There is a tension between GSMA's climate goals of reaching vulnerable individuals, households and communities, and the reliance on commercially viable services that require a certain level of income and resources, often (but not always) including access to mobile digital internet.

Many GSMA grantees (e.g. BKK) are thinking of ways around this challenge through Freemium, USSD/SMS, pay-as-you-go, cross-subsidising, and other options. Some of these are more successful than others at reaching lower-income households with meaningful inputs and services. However, many GSMA grantee project documents do not explicitly identify the degree of

⁵³¹ https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/gsma_resources/exploring-barriers-and-incentives-to-digital-solutions-in-natural-resource-management/

vulnerability of their target populations (producers and consumers), but the models often imply they are reaching those with some degree of existing income and capacity. For some GSMA grantees or projects, there could also be indirect positive impacts on climate vulnerability – for example, more climate-adapted agriculture implies a more resilient food system more broadly. However, such impacts on the vulnerability of more marginalised groups has not until recently been assessed.

More broadly, the focus on commercially viable business models seems to shift the focus away from other uses of mobile digital technology by people. These include communication, coordination, monitoring, and other functions that could contribute to more inclusive and effective collective decision-making and action by stakeholders, including by vulnerable groups, which the broader evidence suggests are important elements of holistic approaches to climate outcomes. Some GSMA partners and their business models do incorporate these uses of technology in their business models.

As GSMA's work and learning on private public partnerships suggests,⁵³² commercial and non-commercial models for mobile digital technologies are not mutually exclusive, and there are opportunities to explore complementarities across these, as will be discussed further below.

1. *Assumption that improving the efficiency of public utilities and agricultural production, contributes to broader climate change resilience*

A number of GSMA partnerships and efforts to leverage mobile digital technologies to improve urban services are aimed at improving the efficiency of the service. Examples include Wonderkid for water service providers. The assumption seems to be that improving the efficiency of these utilities will enable them to invest the savings in improving the resilience of the water system and potentially expand access. This is not an unreasonable hypothesis, but it is one that needs to be explored and validated with some evidence. It seems equally plausible that utility companies might use the revenues for other purposes, or even keep them as increased profits. Furthermore, it would seem likely to vary from one service provider to another depending on their strategic plans, governance structures, incentives, etc.

In the context of agriculture and food systems, GSMA's climate portfolio supports a number of businesses providing advisory and other services to farmers (including fish farmers, in the case of Aquarech in Kenya). In addition to addressing the climate vulnerabilities of farmers accessing their services (through free or full-priced models), there seems to be an implicit assumption that improving the efficiency of food production will contribute to broader systemic resilience in rural areas. This is also a relatively reasonable assumption for producers oriented to local markets. However, it is also the case that food production does not automatically translate into food supply or food security, given the international nature of agricultural markets. This is another hypothesis that would need to be validated requiring specific mention of consumers in project-level theories of action and evidence from the geographies where GSMA is supporting agricultural producers.

2. *Assumption that the most relevant and impactful uses of mobile digital technology for meaningful climate action and outcomes for vulnerable groups are those that are also economically viable and scalable.*

More broadly, the focus on profit-generating business models may shift the focus away from uses of digital mobile tech that may not be commercially profitable. These include communication, coordination, monitoring, and other functions that could enable more inclusive and effective collective decision making and action by vulnerable groups, which evidence suggests are relevant elements of holistic approaches to climate action and outcomes.

Commercial and non-commercial models for mobile digital technologies for climate action are not mutually exclusive. The broader evidence on climate tech suggests that individuals often use mobile

⁵³² [Urban Innovation, Climate Change, Intermediary Cities: World Cities Day reflections | Mobile for Development](#)

digital for communication and gathering information, and many mobile digital technology solutions are oriented to the generation and/or provision of information to individuals; there are few examples of leveraging a broader range of uses of digital mobile technologies. There is little evidence that GSMA supported efforts are identifying and leveraging synergies between commercial and broader uses for more meaningful adaptation, resilience, NRM, etc.

For example, GSMA insights work in climate finance focuses on various technologies to connect individuals to carbon markets, but does not engage with the evidence that individuals and communities need to have visibility on, participate in, and monitor climate finance to ensure that resources meet their collective needs. Similarly, GSMA proposed solutions for sustainable natural resource management generally doesn't fully acknowledge the need to enable collective information sharing, decision making and action by resource dependent communities that is highlighted in the broader evidence.

A notable exception is the GSMA collaboration with World Vision and Ushahidi in Kenya. The project uses SMS and USSD to engage communities in sharing their experiences. These channels were chosen because they were widely known and accessible. By prioritising basic phones over smartphones and using prepaid short codes, the Ushahidi platform effectively boosted community engagement and facilitated ongoing dialogue.

- 3. Assumption that relatively light-touch, relatively isolated technology-based solutions, particularly those that increase information and awareness of individuals and groups, contribute to meaningful adaptation, resilience, natural management, etc. for vulnerable groups.*

This seems to be a dominant assumption underpinning the Innovation Fund, but is also observed in most other GSMA projects. This approach of promoting specific digital technology 'solutions' generally does not align with the evidence of effective climate action, which suggests the need for more holistic and systemic approaches. This is likely partly related to the inadequate assessment and understanding of the vulnerabilities of target groups, constraints on sustainable and inclusive natural resources management, etc. by GSMA and partners. There are some examples where GSMA is supporting complementary inputs or connecting mobile digital to more holistic approaches (for example, in work with World Vision Kenya), but generally these seem to be the minority. Examples include:

- A set of grantees to provide several complementary services around the around the Smart Villages model in Pakistan.
- Taki ni Mali to strengthen use of mobile digital tech in existing solid waste disposal/recycling systems.
- Partners like BKK and Aquarech incorporating a bundle of services to complement their initial service offer.
- 4R Digital's CaVEx platform to connect carbon markets and mobile money to existing CSR reforestation efforts by Safaricom and community forestry associations.

Even in these cases, it is unclear whether there was a robust analysis of the vulnerabilities and challenges faced by target populations, and whether the bundle of services will meaningfully and sustainably address these, particularly for vulnerable groups.

Relatedly, there is a strong emphasis in the Climate Tech Impact Narrative on mobile digital technology solutions that provide information to different actors, particularly vulnerable individuals,

households and communities. The assumption is that based on this information these actors and groups will be able to take meaningful actions to address their vulnerabilities, sustainably manage their natural resources, etc. However, there is significant evidence that a diversity of internal and external factors shape the capacity and motivations of individuals and groups to act on information they are presented with. For vulnerable groups, the diverse causes of vulnerability often constrain their capacity to act on information about potential actions they could take to reduce their vulnerability. Even when vulnerable individuals or groups do take action on the basis of information provided to them, this generally only leads to modest positive actions and outcomes, again given the broader constraints and causal factors underpinning their vulnerability. Generally, information provision alone is insufficient to influence meaningful action, unless supportive and enabling factors are present. This assumption seems more prominent in strategic documents at the portfolio level than in practice, where GSMA staff and partners often seek to go beyond information provision.

Similarly, there is a strong emphasis on informing government and other actors based on evidence, insights or other information and awareness-raising as leading to action to support or engage mobile digital technology solutions for climate actions and outcomes. Significant aspects of the insight work seems to rest on assumptions about the uptake of reports, including (but not exclusively) by government actors. However, the capacities, incentives and opportunities of government actors in LMICs are shaped and constrained by complex factors. Thus, unless there is a relatively strong enabling environment and/or other conducive factors, information and awareness alone are unlikely to contribute to meaningful actions by government officials and bureaucrats.

Often, GSMA efforts seek to engage with government actors who do possess the capacity and incentives to act to support and/or leverage climate tech solutions. However, government personnel, incentives and other factors shift over time. Thus, there is a degree of understanding of and engaging with the enabling and constraining factors faced by government actors beyond information and awareness. This implies some level of assessment, monitoring, learning and adaptation as part of GSMA's brokering role vis-à-vis government actors to increase the likelihood of sustained positive engagement and outcomes. GSMA's convening efforts in practice seem to reflect this reality, as they work to identify and align actors and incentives in both public and private sector, but the organisation could be more clear about the role of a set of factors (awareness and information, capacity, incentives, relationships, etc.) in enabling and constraining public sector actors.

4. *Assumption that there will not be unforeseen negative consequences of relatively light-touch, relatively isolated technology solutions (that are economically viable and scalable) seeking to contribute to meaningful resilience, adaptation and environmental management, particularly for vulnerable groups*

There is generally little evidence of GSMA explicitly identifying or supporting grantees to identify potential unforeseen consequences of the mobile digital solutions that are being proposed. For example, BKK is moving into selling information from farmer users to financial services companies, but with little consideration of what the impacts might be on farmers. Nor is there evidence of considering the longer-term consequences of a largely 'coping' adaptation for through free version of BKK service, possibly leading to maladaptation, a risk noted in the broader evidence.

Another example includes 4R Digital putting in place a platform and related technologies to connect forest associations to carbon markets. The team acknowledged the complexities of these arrangements, but there is no clear evidence of thinking about the implications of introducing these financial resources to forest associations and communities. GSMA's related insight work on mobile digital technology for climate finance also does not meaningfully acknowledge or engage with these complexities.

As noted above, there is at least the potential for unforeseen consequences of scaling up private solutions to climate finance, adaptation, renewable energy and natural resource management that

are inherently focused on lower-middle income individuals and households. This could shift attention, resources and incentives away from broad-based, inclusive and public (or public–private) programmes and approaches, thus potentially and inadvertently contributing to leaving behind the most vulnerable populations.

5. *Assumption that it is not necessary to more intentionally engage with and co-create mobile-based climate actions with vulnerable populations, including civic actors that represent and/or are embedded with these populations*

While this is increasingly called for in GSMA's thinking and documentation, it seems to be the exception rather than the rule in practice. Even then, it sometimes predates GSMA engagement, like Safaricom's existing relationship with community forestry associations before the 4R Digital project. It does not necessarily seem to be obligatory for GSMA grantees to engage and co-create with target groups, as some of GSMA's research and positioning suggests it should be.

When GSMA engages or convenes an ecosystem of actors, this seems to seldom include representation of the groups they are hoping to benefit. For example, many countries have different farmers associations, including at the national level, but they do not seem to be included in GSMA convening efforts.

Additionally, many countries and cities in LMICs have associations representing informal settlements or civil society organisations embedded in those communities, but it is not clear that these have been included in Digital Utilities' convening. One exception is the engagement with the Kenya Alliance of Resident Associations, although it is not clear how representative this group is of more informal or peri-urban communities that are the most climate vulnerable and most excluded from public services.

Annexe 13: Three models for leveraging mobile digital technology for climate impact

GSMA partnerships have played a role with respect to developing and scaling mobile digital technologies for climate action. Given GSMA's connections to mobile network operators (MNOs), the organisation has largely sought to leverage this relationship to support the development and scaling of commercially viable mobile digital technologies and approaches, including experimentation with different pricing models. There are significant advantages to this approach, but the discussion of the ToC and cases above also suggest limitations that need to be considered.

Drawing on the assessment of GSMA's climate action ToC, the evidence and assessment of the climate actions supported by GSMA presented thus far (EQ2), and the broader evidence discussed in EQ1, we propose three pathways for leveraging mobile digital technologies for climate impact. The pathways vary principally in the financial models underpinning them: commercial, non-commercial and combined approaches. As noted, GSMA's work has focused principally on the first, but there are some existing or potential examples in the other pathways as well. Assessing these pathways will provide further insights on how GSMA can further strengthen its niche, role and contribution to inclusive, meaningful and sustainable climate impacts.

Commercially viable uses of mobile digital technologies that meet a clear need and reach significant scale

1. Overall potential feasibility and impact
 - i. Generally strong feasibility (some failures could be avoided with more assessment and integration of actors, challenges and constraints, policy enabling environment)
 - ii. Variable climate impact (generally low to moderate)
2. Many examples across the climate portfolio including most discussed above: Lersha, BKK, several Digital Utilities partnerships/projects (Wonderkid, Freetown Waste Transformers, ATEC, etc.)
3. Pros:
 - i. Taps into market incentives for potential scale and sustainability
 - ii. Leverages GSMA's linkages to MNOs, investors, and other actors working on mobile digital climate technologies
 - iii. Clear fit for some kinds of climate action products/services
 - a. Livelihoods related (agriculture, aquaculture)
 - b. Household needs (clean cooking stoves)
 - c. Improved efficiencies in service delivery
 - iv. In some cases there are fewer stakeholders, so the process can be more streamlined
4. Cons:
 - i. Climate impact is mediated by commercial viability of the technology and business model
 - a. E.g. More efficient service delivery may or may not lead to climate outcomes
 - b. E.g. Services to farmers may not address some important areas of adaptive capacity
 - ii. Generally less accessible to more vulnerable groups who lack access to mobile digital and disposable income to invest in services or resources offered, including urban services
 - a. Some promise from non-digital (SMS, USSD), Freemium, pay-as-you-go, other cross-subsidies, or other strategy, but still limited in who they can reach with meaningful services and resources

- iii. Less evidence of success for more complex climate challenges like highly vulnerable populations, sustainable natural resources management and strengthening systemic resilience
 - a. Some promise from stacking or bundling more services (e.g. Lersha) or exploring synergies among multiple service providers (e.g. Smart Village programme), but still clear limits for complex challenges
 - b. Some climate actions, like early warning systems may not be best fit for commercialisation model, as they benefit more as public goods available to all
5. What does it take to do this most effectively?
- i. Connect to MNOs to leverage resources, expertise, scaling possibilities, etc.
 - ii. To the extent possible, integrate the four elements of holistic climate action suggested by broader evidence in EQ1 (system analysis, holistic approach, include target groups, engage governance and institutions), including:
 - a. Understand the broader climate ecosystem of actors and factors, including structural, socio-political, and individual behavioural factors influencing access, uptake and impact of mobile digital, including nature and causes of climate vulnerabilities of target populations; other relevant actors and factors (e.g. government agencies and policies) in the space
 - b. Support to climate-oriented businesses to analyse, design, iterate, and scale mobile digital technology, service offering and financial sustainability, including engaging target populations and groups
 - iii. Strengthen MEL to both track indicators of progress towards climate impacts and learn and adapt based on progress and challenges encountered
6. GSMA potential role
- i. Brokering connections and partnerships (including for co-design with target populations; civil society organisations, MNOs; government)
 - ii. Funding co-creation, innovation and scaling
 - iii. Technical assistance and capacity strengthening (including more assessment of vulnerabilities of target groups, systemic challenges and enablers, potential for climate outcomes, etc.)
 - iv. Insights and learning to inform innovation, collaboration and adaptation

Non-commercially viable uses of mobile digital technologies as part of more holistic approaches to addressing significant climate challenges

- 1. Overall potential feasibility and impact
 - i. Variable potential feasibility (depends on source of climate financing and leadership that shapes a conducive enabling environment and anchors collective progress)
 - ii. Variable climate impact (generally moderate, but potentially higher where holistic and systemic approaches can be put in place)
- 2. Examples include World Vision Kenya, 4R Digital/Safaricom carbon markets,⁵³³ Pakistan Universal Service Fund funding for Smart Villages and support for AI Forest Fires
- 3. Pros:
 - i. Allows for meaningfully addressing complex climate change challenges like strengthening resilience of vulnerable groups and improving the sustainability of contested natural resources and fragile ecosystems through a holistic, systemic and problem-oriented approach

⁵³³ See further discussion in following section

- ii. Potential for somewhat lighter touch engagement by GSMA and partners if they are providing specific connections and/or technologies to an existing or emerging climate action approach
4. Cons:
- i. Requires other financial support for more meaningful and sustainable change. Carbon markets are a potential option here, but other sources of public and private climate finance should be considered, both international and domestic (including effective MNO CSR where there is genuine commitment).
 - ii. Requires significant efforts in stakeholder engagement and alignment to set up and make meaningful progress
 - iii. GSMA and partners would potentially have less prominent roles and contributions (potentially more significant where MNOs and other GSMA partners closer to the centre of the approach, like Kenya reforestation and carbon markets collaboration)
5. What does it take to do this most effectively?
- i. Integrate the four elements of holistic climate action suggested by broader evidence (system analysis, holistic approach, include target groups, engage governance and institutions)
 - a. Significant connecting, convening and brokering with a diverse set of relevant actors
 - b. Enough time and resources to undertake a meaningful alignment and co-creation process before starting, and continuing these efforts over the long term
 - ii. Robust and shared MEL that helps track and assess intermediate and longer-term changes, as well as reflect, learn and adapt among multiple stakeholders
6. Potential GSMA role
- i. Identifying potential opportunities for integrating mobile digital technologies in broader climate action approaches
 - ii. Shared or supporting role in connecting, convening and brokering
 - iii. Technical assistance and capacity strengthening to develop and integrate mobile digital technology (including more assessment of vulnerabilities of target groups, systemic challenges and enablers, potential for climate outcomes, etc.)
 - iv. Direct funding for innovation as well as helping broker other funding sources
 - v. Potential funding for co-creation, innovation and scaling
 - vi. Insights and learning to inform innovation, collaboration and adaptation

Combining commercial and non-commercial uses of mobile digital technologies as part of more holistic approaches to addressing significant climate challenges

- 1. Overall potential feasibility and impact
 - i. Variable potential feasibility (depends on source of non-commercial climate financing and leadership that shapes a conducive enabling environment and anchors collective progress)
 - ii. Strong climate impact (potential for high impact where holistic and systemic approaches can be complemented at scale through commercially-viable services or products)
- 2. Indicative examples from GSMA portfolio⁵³⁴ include sectoral public–private partnerships (PPPs) between governments, service providers, MNOs and businesses providing mobile digital technologies and services that the Digital Utilities programme is seeking to broker (e.g.

⁵³⁴ Other examples beyond what is listed include: In Pakistan there is a [PPP between JAZZ, CINSR, and PESCO](#); In Kenya, there is the work of CityTaps [and Wonderkid](#);

Freetown solid waste removal). Potential examples that could be taken forward (discussed further below) include:

- i. Building around the Smart Villages programme in Pakistan by bringing together partners like BKK, CROP2X, Buraq, and other actors and efforts (e.g. FAO and Smart Villages initiative)
- ii. Exploring alignment between Safaricom/CaVEx and World Vision Kenya approaches in Kenya

3. Pros

- i. Allows for meaningfully addressing complex climate change challenges like strengthening resilience of vulnerable groups and improving the sustainability of contested natural resources and fragile ecosystems through a holistic, systemic and problem-oriented approach
- ii. Potential for more meaningful and sustainable impacts at scale by leveraging market incentives to complement holistic climate approaches
- iii. Leverages GSMA's linkages to MNOs, investors, and other actors in the broader climate action ecosystem

4. Cons

- i. Requires other financial support for more ambitious/meaningful change, carbon markets being one option for some kinds of outcomes (that at least include mitigation components)
- ii. Requires significant efforts in stakeholder engagement and alignment to set up and make meaningful progress
- iii. May be challenging to find a good fit between commercial and non-commercial uses of mobile digital technologies to address specific problems

5. What does it take to do this most effectively?

- Integrate the four elements of holistic climate action suggested by broader evidence (system analysis, holistic approach, include target groups, engage governance and institutions), including:
 1. Understand the broader climate ecosystem of actors and factors, including structural, socio-political, and individual behavioural factors influencing access, uptake and impact of mobile digital, including nature and causes of climate vulnerabilities of target populations; other relevant actors and factors (e.g. government agencies and policies) in the space
 2. Significant connecting, convening and brokering with a diverse set of relevant actors in the broader climate action ecosystem
 3. Enough time and resources to undertake a meaningful alignment and co-creation process before starting, and continuing these efforts over the long term
- Robust and shared MEL that helps track and assess intermediate and longer-term changes, as well as reflect, learn and adapt among multiple stakeholders
- Support to climate-oriented businesses to analyse, design, iterate, and scale mobile digital technology, service offering and financial sustainability, including engaging target populations and groups

6. Potential GSMA role

- i. Identifying and exploring potential opportunities and alignment
- ii. Shared role in connecting, convening and brokering (including for co-design with target populations; MNOs; government)
- iii. Funding co-creation, innovation and scaling
- iv. Technical assistance and capacity strengthening (including more assessment of vulnerabilities of target groups, systemic challenges and enablers, potential for climate outcomes, etc.)

v. Insights and learning to inform innovation, collaboration and adaptation

