GSMA

Exploring barriers and incentives to digital solutions in Natural Resource Management

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REVERSING ENVIRONMENTAL DEGRADATION REDAA IN AFRICA AND ASIA

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UKaid from the British people

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The views expressed do not necessarily reflect the UK government's official policies.

BUSARA The Busara Center for Behavioral Economics is an advisory and research organisation focused on advancing and applying behavioural science in the global south in pursuit of poverty alleviation. Busara was the research partner for this study.

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Executive summary

Biodiversity loss, driven primarily by human activities such as habitat destruction and over-exploitation, pollution and climate change, is one of the most pressing environmental challenges of our time. Up to one million species are at risk of extinction, while 75 per cent of land surface has been significantly altered by human activities and over 85 per cent of wetlands have been lost.[1] These pressures on nature not only threaten the survival of countless plant, fungi and animal species, but also have far-reaching consequences for human welfare, including the provision of food, water, and livelihood security.

Indigenous people and local communities (IP&LCs) have long been the primary caretakers of natural resources. While Indigenous people comprise around six per cent of the global population, they are protectors of an estimated 80 per cent of the world's biodiversity.[2] Land rights are under attack around the world; to date, governments have acknowledged their legal right to use or own just 18 per cent of land worldwide.[3] Although the effects of exploitative resource extraction are felt most strongly by IP&LCs, they often receive far less than their share of resource-derived wealth.

Digital technology unlocks new potential to address these interconnected challenges and help IP&LCs manage natural resources by reducing and reversing biodiversity loss.[4] Research reveals strong examples of digital solutions improving the efficiency, efficacy and equality of natural resource management (NRM)[5] activities in the global south.[6] From the use of big data to predict air pollution[7] and restore mangroves,[8] to GPS technology and remote sensing to track and protect wildlife,[9,10] the application of diverse technological interventions is on the rise. Furthermore, initiatives such as MappingForRights[11] and Cadasta[12] have leveraged digital tools to help empower IP&LCs to map and monitor their resources and reclaim their rights.

However, if the IP&LCs who take responsibility for the management of natural resources cannot directly benefit from the use of such technologies, long-term uptake and impact will be challenging to achieve. Currently, evidence on how to improve digital technology adoption and its success among IP&LCs is fragmented, making it difficult for stakeholders to learn from best practices, replicate success or identify opportunities for collaboration.

With this evidence gap in mind, the FCDO-funded Reversing Environmental Degradation in Africa and Asia (REDAA) and GSMA ClimateTech programmes collaborated to carry out research identifying barriers and best practices for digital technologies designed to help local communities in low- and middle-income countries in their efforts to manage natural resources sustainably. Drawing from desk research, stakeholder consultations and lessons learned from three case studies in Asia and Africa, this report presents common challenges faced when designing digital solutions for NRM and recommended approaches for developing new ones.

1 IPBES (2019). Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Brondizio, E.S., Settele, J., Diaz S., and Ngo, H.T. (editors).
2 World Bank (2022). Indigenous Peoples
3 www.rightsandresources.org/tenure-tracking/forest-and-land-tenure (accessed 14 March 2023)
4 See for example: Nitoslawski, S.A., et al (2021). The digital forest: Mapping a decade of knowledge on technological applications for forest ecosystems. Earth's Future.
5 Natural resource management refers to the sustainable use and management of the planet's natural resources, including forests, watersheds, oceans, air and a diversity of plant and animal species.
6 GSMA (2020). Digital Dividends in Natural Resource Management
7 GSMA (2018). Big Data for Social Good. Case Study: Telefónica Brazil
8 https://unfccc.int/climate-action/momentum-for-change/ict-solutions/connected-mangroves
9 https://giraffeconservation.org/programmes/twiga-tracker
10 https://connectedconservation.foundation/technology
11 https://www.mappingforrights.org
12 https://cadasta.org

Barriers to uptake of digital NRM solutions

The research highlighted four key barriers for the success of digital solutions in NRM:

Structural barriers, such as poor internet connectivity, limited smartphone access in communities or costs associated with access to technology. This impacts not only the digital solutions available, but also who in the community benefits from them. For example, it is common for smartphone access to be concentrated among members of communities, particularly those who are younger and male. As such, solutions designed solely for smartphones have the potential to exclude harder-to-reach groups and risk reinforcing existing community inequalities.

Technical barriers result from the limitations of the technology or digital solution itself. Technical issues can pose problems both for the tool's performance and its perceived value among users. If the user considers the technology to be overly complex or confusing, they are unlikely to maintain interest in it. Moreover, it should not be assumed that 'high tech' is always the best solution; 'low tech' can be equally successful. Both the technological infrastructure and enabling environment influence the extent to which different types of solutions should be considered.

Social barriers reflect how communities interact among themselves and prevalent social norms. Existing power dynamics can pose challenges to inclusive and equitable outcomes. For example, women in the community may have less mobility, a limited role in NRM decision-making or lower digital literacy, which could be further exacerbated if such factors are not considered carefully within the digital solution's design.

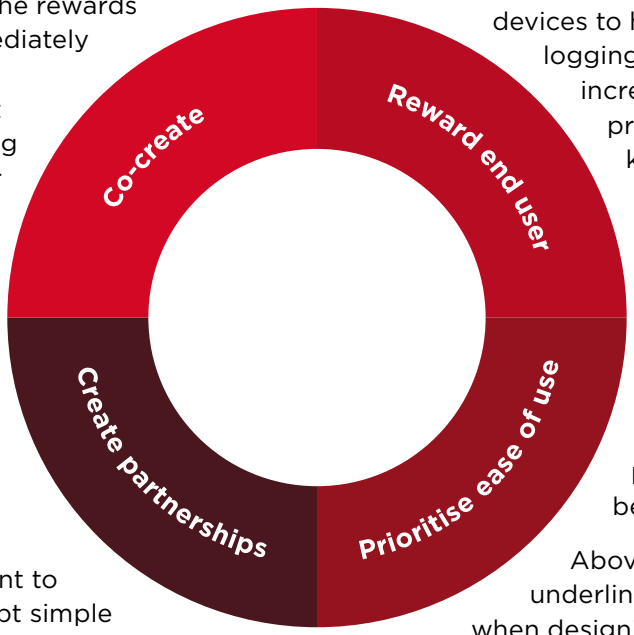
Motivational barriers are a result of human tendencies to behave in certain ways. In any new project, the uptake and continuous use of a digital solution will always be balanced against individual concerns such as limited attention spans, personal circumstances or resistance to change. If the end user does not feel the solution is directly and tangibly solving a problem in their daily lives, attrition is more likely.

By considering the different levels of influence on an individual or community's behaviours, projects can develop targeted interventions to address the specific factors that inhibit the desired NRM outcomes and identify the most effective strategies for promoting technology adoption.

Best practices for driving uptake of digital NRM solutions

The research identified best practices while attempting to digitalise the management of natural resources that are applicable across different geographies, type of natural resource and variety of technology usage.

The most salient driver in the success of a digital solution is its ability to **provide clear and direct rewards for the end user**. Tangible benefits, such as financial incentives, were found to be particularly successful in mobilising and securing longer-term community engagement. An example of this is the Fairtree[13] pay-to-grow system which uses the Treetracker mobile application to incentivise users in East Africa to grow and maintain trees with direct mobile payments. As the rewards of reforestation are not immediately felt, Fairtree circumvents the potential loss of engagement among end users by providing financial incentives at regular intervals after a new tree has been planted. This both incentivises the survival of the trees, as well as creating a meaningful source of income for tree caretakers.



Solutions must be intuitive and easy to use. Regardless of the technology being designed (ranging from low tech to frontier), it is important to ensure user interfaces are kept simple and engaging to improve uptake among local users. For example, India Observatory[14] developed the Composite Landscape Assessment and Restoration Tool (CLART) mobile application to improve the planning and management of soil and water resources in communities across India. The app translates complex data into colour-coded maps available in local languages, which can be easily navigated by users with low literacy levels. Solutions should also build on IP&LC's knowledge and practices already in place, with a 'bottom-up' approach to understanding the local context.[15] This helps to ensure solutions are designed in a way that aligns with, and elevates, long-standing or traditional community activities.

Working in partnership is central to long-term success. A critical best practice for digital NRM solutions is to partner with trusted community members or established local organisations to introduce and champion the solution, as well as build the capacity of local users to maximise engagement with technology. This helps to overcome potential pushback from community members against external actors, given that local partners are best placed to navigate the power dynamics in each area and advocate for the solution. For example, in Sumatra, Indonesia, Rainforest Connection[16] partnered with an established grassroots non-governmental organisation (NGO) KKI Warsi[17] to introduce their solar-powered acoustic monitoring 'Guardian' devices to help protect forests from illegal logging or poaching. The partnership increased buy-in with end users, provided context-specific knowledge and maximised the impact of the tools. The research also highlighted that when a digital technology is built upon or embedded within local community structures, existing government programmes or widely-adopted digital payments systems, it tends to be more trusted and used.

Above all else, the research underlined the **value of co-creation** when designing digital solutions for NRM. Co-creation in this context recognises that IP&LCs have a deep understanding of their environment and the challenges they face, and their knowledge can inform the design of more effective and sustainable digital solutions. This has been exemplified by the Group on Earth Observations (GEO) Indigenous Alliance, who use hackathons[18] to co-design creative digital solutions with Indigenous communities.[19] By involving end users and other key stakeholders in the design process, alongside individuals offering technical expertise, solutions can be better tailored to meet the specific needs and contexts of the communities they are created to serve. This can result in greater purchase and long-term sustainability of the solutions, as well as more equitable outcomes.

13 https://fairtree.org
14 https://www.indiaobservatory.org.in/tool/clart
15 REDAA ESRC Scoping Paper (2022). Low tech, bottom-up, place-based approaches
16 https://rfcx.org/
17 https://warsi.or.id
18 The GEO Alliance virtual hackathons are hardware and software marathons that take place online. Participants are given a limited timeframe (e.g. 44 hours) to work towards solving a pressing challenge co-designed by Indigenous communities around the world.
19 https://earthobservations.org/geo_indigenous_alliance.php

Recommended steps for designing a digital NRM solution

With these barriers and success factors in mind, the report recommends five steps for practitioners to consider when designing digital solutions for NRM.

The guidelines outline key factors to consider to empower local communities with tools to protect their surrounding ecosystems. The steps include:

1	**Align and build trust**	Before any solution is considered, the establishment of mutual trust between all parties is of utmost importance. This can be fostered by discussing shared learning needs, creating safe-space communication, and ongoing relationship building. Alignment helps to ensure all relevant stakeholders are on the same page. End users, funders, developers and partners should be united in the expectations and goals of the project. When key decision-makers do not have the same vision from the start, it can lead to issues with sustained usage and community buy-in down the line.
2	**Understand**	Talk to end users and other key stakeholders. Ask questions about the NRM problem you are trying to solve, the relationship between the local community and the resource, and the existing power dynamics and structures that exist in the target user population. At the end of this step, you should be able to clearly define the central NRM problem and its implications on various stakeholders. This will help to avoid duplication of efforts and unsuccessful solutions, ground the technology in the specific context, and ensure local participation.
3	**Co-design**	Use co-design workshops to develop locally relevant solutions to tackle the identified problem(s). Rank options to identify the most feasible and impactful ideas. Test low-fidelity prototypes of the top ideas with key stakeholders for feedback on ways to improve design, exploring how the solution may help or hinder NRM efforts. Use these insights to choose which prototype to move forward with and how to improve the effectiveness of the solution.
4	**Pilot**	Use a pilot rollout of the solution to assess the uptake and impact of the technology among end users. Clearly define what is meant by impact before you measure it; for example, if it is being considered from the perspective of the natural resource itself, or the users' empowerment to participate in NRM decisions. Use this as an opportunity to learn more about the solution and iterate accordingly. If the solution has failed to achieve the desired level of uptake and impact, revisit steps one to three.
5	**Learn**	Develop key performance indicators to monitor engagement with the tool, allowing for prompt identification of new or emerging challenges. When you have a co-created and contextualised digital NRM solution, make sure to share lessons learned. Creating meaningful insights for others to learn from and apply in different contexts can help create impact beyond your own end users and strengthen NRM efforts elsewhere.

Mobile and digital technology holds immense potential for empowering IP&LCs in their vital role as caretakers of the world's natural resources. By facilitating efficient and sustainable NRM, digital solutions can help to reverse the loss of biodiversity and safeguard the well-being of crucial species.

However, the full potential of these tools can only be realised by addressing the barriers to adoption and implementation, including structural, technical, social, and motivational challenges. Through strategies and approaches that keep IP&LCs at the centre of every design, digital solutions can play a transformative role in empowering communities to conserve the natural resources upon which we all depend.

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