



Digitalising Innovative Finance: Emerging instruments for early- stage innovators in low- and middle-income countries



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Authors: Samuel Miles (Mondato), Arielle Jaffe (Mondato), Judah J. Levine (Mondato), George Kibala Bauer (GSMA), and Zach White (GSMA)

Contributors: Akanksha Sharma (GSMA) and Brian Njoroge (GSMA)

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Foreword

Climate change and the related threat of global inequality has created interacting threats to not only the global ecosystem, but also to the social fabric within and between nations and regions. With clean energy technology now at or below cost parity with fossil fuels, the next wave of the march to sustainability must be to close the many other barriers that hold back the Just Energy and Climate Transition.

Foremost among these barriers is the massive gap in funding for essential services and infrastructure in low- and middle-income countries (LMICs). When it comes to energy access, Sustainable Energy for All estimates the annual financing gap to achieve Sustainable Development Goal (SDG) 7 to range between \$500 and \$750 billion per year. Financing gaps in other sectors such as water, sanitation, waste management, and transport are also persistently massive. Concessional donor and philanthropic support alone will not be able to meet the funding requirements for essential services. Unlocking private sector funding is key to meeting the SDG agenda and supporting LMICs in their climate change transitions.

The recognition of inequalities has, sadly, not led to meaningful action. While there is a broad consensus that private capital must be mobilised to achieve the SDGs, initiatives to “crowd-in” private sector financing for development impact have thus far fallen short of expectations and stated goals. Today, many innovative financing instruments exist that are exceedingly promising, progressive (pro-justice), and hold the potential for bridging this gap. Implementation lags ideas, however, and if technological innovation were needed to revolutionise clean energy, the financing gap is, if anything, even more engrained in our mental and systemic models. The effort and scale of existing innovative finance is in a delayed infancy and has yet to crowd in additional private capital at the scale required to move from ‘billions to trillions’ for the Just Transition.

The rise of mobile connectivity and digital adoption across LMICs is a bright spot that has – in limited examples – already enabled the emergence of digital technologies that can play a significant role in unlocking some of the untapped potential of innovative financing mechanisms in LMICs. Technologies like digital platforms, artificial intelligence (AI), blockchain and the Internet of Things (IoT) have not only transformed how SMEs, start-ups, and social enterprises in these markets operate, but have also enabled more data-driven financing approaches that are tailored to the market context in which these companies are operating. This report shows how promising these modernised technology systems are and how they could unlock capital for a hot, crowded, and inequitable planet.

As this report makes clear, there has been too little research looking explicitly at the role of digital technologies in enabling innovative financing approaches. Different donors, funders, and operators use different terms and frameworks to describe certain approaches, and the value-chains and partnerships underpinning various digitally enabled financing approaches are poorly understood. There has also been a tendency to focus on particularly flashy silver-bullet solutions, and to underestimate the market and operational complexities in which these financing instruments are deployed. For instance, while results-based financing has been around for a long time, and might not be seen as particularly innovative, digital innovation holds tremendous potential in helping RBF programmes to be deployed more efficiently and to operate at greater speed and scale. Digital technologies also offer unique opportunities for different funders to collaborate and to combine different financing instruments. For instance, IoT monitoring tools can be used to monitor and verify information for a range of financing instruments such as RBF, carbon credits, or receivables financing.

Digital technologies also offer critical insights into key techno-economic and operational challenges to scaling essential services such as energy access, as well as quantifying their wider social impact. These insights can be leveraged by a wide range of funders and enabling organisations. The digitalisation of business operations in clean cooking, and off-grid solar demonstrates this trend and has enabled private sector innovators in these sectors to unlock access to various innovative financing mechanisms. The ability to more accurately track the impact and commercial viability of these organisations through digital technology will transform the ways in which these use cases are financed, enable a greater number of both impact-focused and commercially-oriented funders to finance them, and drive funding to organisations in countries that have previously not been able to attract investment.

This report offers an exciting, and uplifting framework to track and analyse digitally enabled financing options that can be used to establish common platforms that can enable collaboration across different stakeholders in the financial ecosystem. It also establishes the maturity of different instruments and deep dives into innovative finance instruments that hold particular potential for scalable development impact. As this ecosystem of use cases matures further, it is critical to establish more evidence on the return on investment associated with different financing instruments, and the types of financial innovations that are best positioned to deliver financing to the use cases and geographies that maximise development impact.

The authors have done us a great service in not only take the pulse of the financing gap and highlighting bright spots for our attention, but more significantly they have showed us just how close and accessible options to finance just and sustainable societies are. Our job is to digest and internalise these lessons.



Daniel M. Kammen

Daniel M Kammen

James and Katherine Lau
Distinguished Professor of
Sustainability

Professor in the Energy and
Resources Group, and in the
Goldman School of Public Policy

Professor in the Department
of Nuclear Engineering

University of California, Berkeley

Former Science Envoy,
US Department of State

Coordinating Lead Author,
Intergovernmental Panel
on Climate Change

Executive summary

Digital technologies play a significant role in unlocking the potential of innovative financing mechanisms across the utilities sectors in Africa and Asia. Across these sectors, access to capital is a major challenge, particularly when enterprises have outgrown grant funding but do not have the scale to tap into traditional investment channels. Technologies like digital platforms, artificial intelligence (AI), blockchain and the Internet of Things (IoT) can bring innovative financing instruments to the energy, water, waste, sanitation, recycling, mobility and asset-financing sectors. However, the scale of innovative finance has yet to reach its potential, with only a small portion of available development assistance and sustainable private sector capital being mobilised through digitally enabled innovative financing.

There is little research that focuses specifically on the role of technology in unlocking innovative finance in the utilities service sector in low- and middle-income countries (LMICs). This research serves as a first attempt to categorise the complex value chain connecting upstream financiers exploring innovative financing instruments to the midstream digital technology providers and solutions and on to the downstream implementers of utility service delivery and their beneficiaries.

The study uses novel conceptual and analytical frameworks designed to create a common language in identifying and analysing instances of digitally enabled innovative finance. The framework employs three distinct lenses that correspond to the principal stages within the value chain connecting financiers to implementers. This approach acknowledges that the frontier of innovation is continually expanding and context-dependent; what may be commonplace in one area can be considered innovative when applied elsewhere.

To operationalise this framework, each lens was defined through extensive desk-based research as well as consultation with key stakeholders. Limitations to this approach are principally around the interconnected nature of the different financial instruments and technologies which make categories less discrete in real-world applications than in theory. Nonetheless, the framework enables a complex landscape to be broken down into clear components.

Over 80 in-scope use cases were identified through this analytical framework. Use cases and their application of innovative finance instruments are segmented into mature, scaling and emerging categories based on the number of implementation examples documented in the literature, number of countries and sectors, and typical volumes associated with the instrument. These use cases serve to concretise the universe of digitally enabled innovative finance instruments into a catalogue of examples where finance instruments, digital technologies and the transaction mechanisms underpinning them come to life in the real world. The study dives into five innovative finance instruments as case studies - receivables financing, alt-lending, climate, revenue-share models, and digitally-verified RBF - as a means to fully explore the relationship between digital innovation and these evolving models.

Key trends

Maturing use cases include social enterprises' use of financial instruments such as alternative lending, receivables financing and crowdfunding. Digital technologies driving the growth of such use cases principally include advances in satellite imagery and digital platforms that perform analytics on transaction and asset usage data enabled by IoT. Transaction mechanisms that foster the growth of these use cases include traditional mobile money and pay-as-you-go (PAYG) systems. The most mature use cases across the review were principally from the energy sector, with emerging innovation in the cooking space mirroring early successes of the PAYG solar lighting product and solar home systems (SHS) verticals.

Scaling use cases include those leveraging the growth of climate finance, revenue sharing models and digitally-verified results-based finance (RBF) mechanisms. The digital technologies principally driving these use cases are IoT systems paired with digital platforms capable of performing verification analytics, increasingly leveraging AI, and digital ledger technologies. Transaction mechanisms that foster these models include mass-payout electronic payment integrations into digital platforms, as well as embedded finance mechanisms. Use cases exhibiting characteristics of scaling are largely focused on agritech and productive use asset-lending, particularly in the vehicle financing space.

Emerging use cases include social or environmental co-benefits monetisation, impact bonds and various applications of digital tokens and cryptocurrencies. These use cases increasingly leverage innovations in digital identity verification like biometrics and chatbots, as well as digital ledger technologies including smart contracts. Ledger technologies are particularly well represented in the transaction mechanisms underpinning emerging use cases. Emerging use cases were identified across sectors, with digital technologies surfacing as particularly prominent in use cases focused on the co-benefits of climate finance.

Accelerating adoption

Across the use cases considered, the most advanced and innovative organisations have pioneered a specific technology, instrument or business model, layering on additional innovations with time. Enterprises or utility service providers aiming to leverage digital technologies to unlock innovative finance instruments should master the technologies that produce tangible value in their sector, and consider what opportunities are offered by off-the-shelf solutions providers, particularly for IoT platforms, satellite imagery processing or blockchain solutions.

The intersection of climate tech and fintech is an emerging macro trend that will likely impact the landscape of utility service providers. Smartphone penetration and increasing maturity in satellite imagery, IoT platforms, blockchain and AI are creating opportunities for utility service implementers to advance their digitisation journeys. Trends in mobile money interoperability and cross-border connectivity are also poised to unlock additional opportunities for building on PAYG models across Africa and Asia, particularly for receivables finance and climate finance.

Utility service enterprises need to recognise the value of digitisation in leveraging innovative finance. Digitisation processes typically begin with a desire to improve operations, with innovative finance opportunities often emerging as a byproduct. Developing a sector-specific understanding of which technologies are best suited to improving operations is often the first step towards tapping into the most appropriate innovative finance mechanisms.

Financiers across the impact-return spectrum need to leverage the data-sharing opportunities unlocked by digital technologies to generate sector standards. The use of innovative finance specific to the utilities sector is poorly characterised in the available literature. Grant, equity and debt financiers can leverage the exponential increase in data generated by utility service providers to develop and share sector-specific benchmarks that can generate, benchmark and socialise both commercial and impact indicators.

Global corporations need to support transparent, and accessible financial intermediaries and instruments that can effectively allocate impact-oriented capital flows. Increased attention on corporate climate and ESG impact metrics means that corporations need to drive digitally enabled mechanisms that can support standardised, timely, and reliable impact data.

Mobile network operators (MNOs) have a key role to play across the landscape of use cases. Growing momentum in utility verticals represents a significant opportunity for operators to develop additional revenue streams and move towards a positioning as a technology partner for organisations in the ecosystem. Laser-focused attention on facilitating third-party access to mobile money integrations across markets can additionally support utility service providers' ability to digitise operations in their financing journeys.

Partnership opportunities highlighted through the landscape emphasise the need for blended finance. Development financiers and impact-oriented investors can unlock new private capital by de-risking investments into technology-enabled sectors through guarantee mechanisms and concessional forms of investment. Such partnerships represent the opportunity to include novel players like local banks and public agencies in pioneering otherwise poorly understood financial instruments across new geographies.

Achieving an inflection point in innovative finance using technology will require dedicated efforts in breaking down silos across the investment landscape. The returns on investing in digital innovation can take years to be realised, and typically require time and effort to understand for those not already immersed. This report serves to capture some of the most significant intersections of technology and finance trends that will guide the needed deployment of climate-resilient, pro-poor capital in the utility service sectors in the coming decade.

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Abbreviations

ABS	Asset-backed securitisation
AI	Artificial Intelligence
APIs	Application programme interfaces
CRM	Customer relationship management
DFIs	Development finance institutions
DLT	Distributed Ledger Technology
dMRV	Digital monitoring, reporting, and verification
FMCG	Fast-moving consumer goods
IoT	Internet of Things
ITMOs	Internationally transferred mitigation outcomes
LMICs	Low- and middle-income countries
MNO	Mobile network operators
OECD	Organisation for Economic Co-operation and Development
PAYG	Pay-as-you-go
PPAs	Power Purchase Agreements
RBF	Results-based finance
SDGs	Sustainable Development Goals
SHS	Solar home system
SMEs	Small and medium-sized enterprises
USSD	Unstructured Supplementary Service Data

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1 Introduction

This report highlights the role digital technologies can play in crowding in private sector capital to social enterprises through innovative financing mechanisms. It demonstrates how digital technologies enable new structures for combining commercial and impact-oriented capital in ways that make utility services more affordable to low-income customers. It also considers how digital technologies can help funders make more effective and efficient use of existing funds. The research focuses on ‘missing middle’ investments, where social enterprises have grown too big for grant funders but are typically still too small or deemed too risky for traditional commercial investment.¹ While several studies over the past decade have broached the potential of innovative finance for achieving such social development targets, the specific role of digital technology has received less focus.

To achieve the United Nations’ Sustainable Development Goals (SDGs), trillions in additional funding must be leveraged from the private sector to complement public sector spending. According to the OECD, the current estimated SDG financing gap, exacerbated by the COVID-19 pandemic, is \$4.2 trillion per year.² Key barriers to private capital contributing to this gap include a lack of data on, and familiarity with, investable opportunities in low- and middle-income countries (LMICs) as well as the complex due diligence necessitated by regulatory, currency and market risks.^{3,4,5}

Innovative finance mechanisms hold potential to bridge this gap, and digital technologies can play a critical role.⁶ Many social-impact focused innovative financing instruments were initially pioneered in the health sector. Instruments like guarantee mechanisms, thematic bonds, and results-based finance (RBF) have enabled the mass-scale up of immunisations for children and distribution of treatment for AIDS and tuberculosis.⁷ Meanwhile, there has been tremendous innovation in traditional financing approaches. Instruments like off-balance sheet financing, working capital facilities and asset financing have transformed the way organisations can access different forms of capital. Technology can accelerate the replication of these successes across sectors. World Economic Forum analysis projects that ‘fourth industrial technologies’ like big

data platforms, artificial intelligence (AI), blockchain and the Internet of Things (IoT) have a ‘high impact’ on at least 10 of the 17 SDGs, as well as more than 70% of associated targets.⁸

The scale of existing innovative finance, however, has yet to crowd in additional private capital at the scale required to move from ‘billions to trillions’.⁹ Calculations of the total estimated size of innovative finance vary by study, in line with varying definitions of innovation, but a 2018 review concluded that “resources mobilised by innovative finance is still only about three to five per cent of official development assistance.”¹⁰ While there is a broad consensus that private capital must be mobilised to achieve the SDGs, the contributions of innovative financing practices - such as blended finance, impact investment and result-based finance - have to date fallen short of expectations and stated goals. The lack of clarity and consistency in discourse and research on innovative financing mechanisms has also made it challenging to build a coherent understanding and evidence base of key experiences, opportunities and challenges.¹¹ There remains enormous potential for innovative finance mechanisms targeting utility services to tap into the rise of ‘sustainable’ investments, wherein private investors seek to pair financial returns with social or environmental impact. In North America, Europe, Australia, and Japan over a third of all assets in the world’s wealthiest economies today fall in this category, representing a \$35 trillion opportunity to channel traditional sources of capital to innovators delivering impact.¹²

1. Li, S., et al (2022). *Unlocking Early-Stage Financing for SDG Partnerships*. WRI.
2. OECD (2021). *Global Outlook on Financing for Sustainable Development 2021*.
3. UN PRI (2022). *Closing the funding gap: The case for ESG incorporation and sustainability outcomes in emerging markets*.
4. United Nations (2019). *Roadmap for Financing the 2030 Agenda for Sustainable Development 2019 - 2021*.
5. UNCTAD (2023). *Official international assistance insufficient to reach 2030 agenda*.
6. Dalberg / CitiGroup (2014). *Innovative Financing for Development: Scalable Business Models that Produce Economic, Social, and Environmental Outcomes*.
7. Atun, R., et al (2017). *Innovative financing instruments for global health 2002-15: a systematic analysis*. The Lancet.
8. WEF (2020). *Unlocking Technology for the Global Goals*.
9. Center for Global Development (2022). *Billions to Trillions is (Still) Dead. What Next?*
10. Elmer, P. et al (2018). *Innovative Finance: Putting your money to (decent) work*. ILO.
11. Heinrich-Fernandes, M. (2023). *Donor engagement in Innovative Finance: Opportunities and Obstacles*. DCED Working Paper.
12. Global Sustainable Investment Alliance (2021). *Global Sustainable Investment Review 2020*.

Spotlight 1 Challenges to innovative financing mechanisms

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

Spotlight 2 The role of digital technologies in enabling innovative financing mechanisms

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

regions are able to cover their operational costs through revenue collection, imposing significant financial burdens on national treasuries year after year of up to 2% of GDP.¹⁵ Only about one in three electricity utilities in Africa recover their operating and debt-service costs, for instance. Excluding subsidies, this ratio drops to one in four.¹⁶

13. Balabanyan, A. et al (2021). *Utility Performance and Behavior in Africa Today*. ESMAP.
14. WHO (2017). *Financing Universal Water, Sanitation and Hygiene under the Sustainable Development Goals*
15. GSMA (2021). *Smarter subsidies and digital innovation: Implications for utility services*.
16. Balabanyan, A. et al (2021). *Utility Performance and Behavior in Africa Today*. ESMAP

Innovative service delivery approaches, largely driven by social enterprises, are a crucial complement to public sector efforts. The explosive rise of pay-as-you-go (PAYG) in the off-grid energy sector, for example, has played a significant role in widening access to energy. Combining mobile money systems with machine-to-machine (M2M) communication and remote locking has made off-grid energy products more accessible and affordable to billions worldwide, bringing power for the first time to 25-30 million people worldwide between 2015 and 2020.¹⁷ The success of off-grid energy providers has thus far failed to achieve comparable scale across geographies and sectors though. Investments in the PAYG sector are concentrated in a few large players focused on East Africa, with limited examples of comparable models taking off in clean cooking, water, sanitation or waste services.¹⁸ Efforts aimed at enabling these types of social enterprises to access innovative finance have received relatively less focus within the development finance ecosystem, despite their critical role in widening access to modern goods and services.

1.2 Study methods and approach

This study develops and employs a novel conceptual framework to identify and map recent examples of digitally enabled innovative finance. The framework (see Figure 1 overleaf) uses three 'lenses' that broadly correspond to the upstream, midstream and downstream of innovative finance along the value chain of finance from source to recipient to isolate areas of innovation and enablement. At the outer edge of each lens sit novel and potentially transformative models, while at the core sit more established and widely used models. This approach allows for the reality that the frontier of innovation is both constantly expanding and context-specific (for example, what is commonplace for one geography can be innovative when applied in another).

To operationalise this framework, the 'frontier' for each of the three lenses was defined through extensive desk-based research and validation with stakeholders. The report Annex includes definitions for what was considered core and edge for each of the lenses. Through reviewing published reports and recent press announcements, and conducting expert stakeholder interviews, in-scope use cases were identified as those where a frontier innovation could be clearly identified at the edge of at least two lenses.

17. Power for All (2022). *Power for All Fact Sheet: Off-grid PayGo*.

18. GSMA (2022). *Pay-as-you-go utilities: Innovations and opportunities in Asia*.

This approach has several notable limitations. In practice, the categories across lenses are blurry, and the analysis necessarily involved a simplification and clear categorisation. Similarly, some combinations of financial and technological applications can be taken as a single instrument. PAYG systems, for example, could be considered a financing instrument, a transaction mechanism or a business model depending on the context. The framework was not designed to establish rigid categories, but rather as a tool for decomposing a complex landscape into its constituent parts. The study's source material (press announcements, reports and publications, and interviews) uses different definitions and terms to describe financing activities, limiting comparability across regions. Lastly, many aspects of social enterprise operations or specific information related to fundraising structures or volumes are not well-documented, and not all funding deals are announced publicly, limiting the landscape review to use cases that have received at least some degree of media coverage.

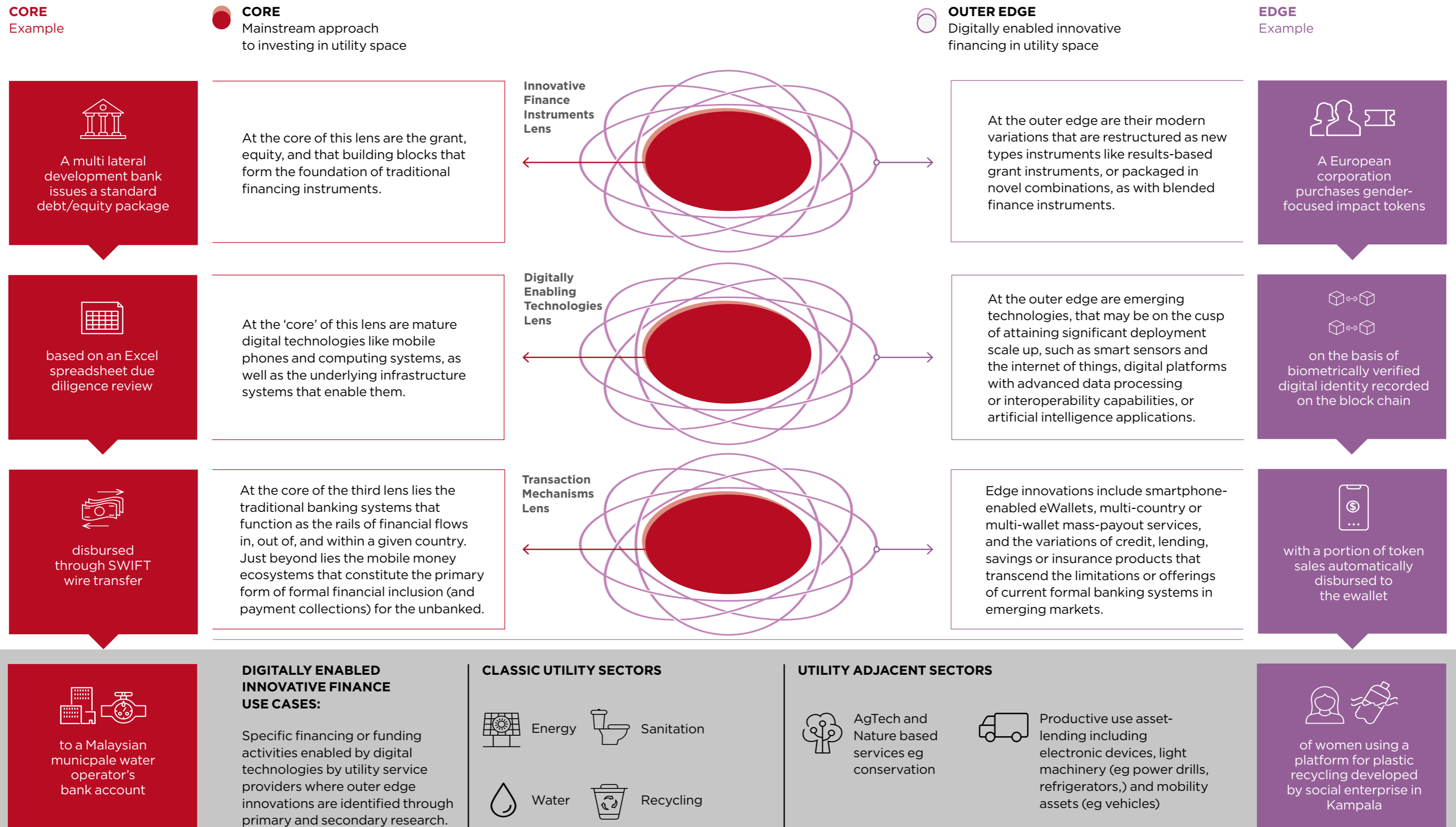
The remainder of this report is structured as follows:

- Chapter 2 presents an overview of the landscape of use cases identified in the review;
- Chapter 3 provides a deeper dive into five innovative finance instruments that appear to offer the highest potential for unlocking replicable and scalable models for social enterprises delivering utility services in Sub-Saharan Africa and Southeast Asia;
- Chapter 4 provides perspectives on likely developments at the intersection of digital technologies and innovative finance trends;
- Chapter 5 concludes with recommendations to stakeholders that are key to scaling innovative finance investments from millions to billions and beyond; and
- The report Annex provides further details of the approach described above, relevant definitions of key terms, a list of all the use cases informing this report, selected trends and their implications, and contains an annotated bibliography of key further reading.

1.1 Relevance to the utilities sectors

The need for innovative finance is particularly pronounced in the context of utility services. Incumbent utility players are making slow progress in increasing coverage access relative to population growth, leaving billions without access to affordable, reliable, safe and sustainable energy, water, waste and sanitation services. Centralised utility providers have limited fiscal space to accelerate access in LMICs, particularly in Sub-Saharan Africa, South Asia and Southeast Asia.^{13,14} Few national or municipal utility entities in these

Figure 1
Conceptual framework





2 Landscape of digitally enabled innovative finance in the utilities sector and beyond

The research identified over 80 use cases in the focus geographic regions that satisfied the inclusion criteria for the study. In scope use cases are defined as where funding is at the 'edge' for two of the lenses described. These were sourced from press releases and stakeholder interviews verified through company websites or published documentation. Figure 1 illustrates the use cases considered in the landscape review, highlighting the main categories associated with each use case across lenses.

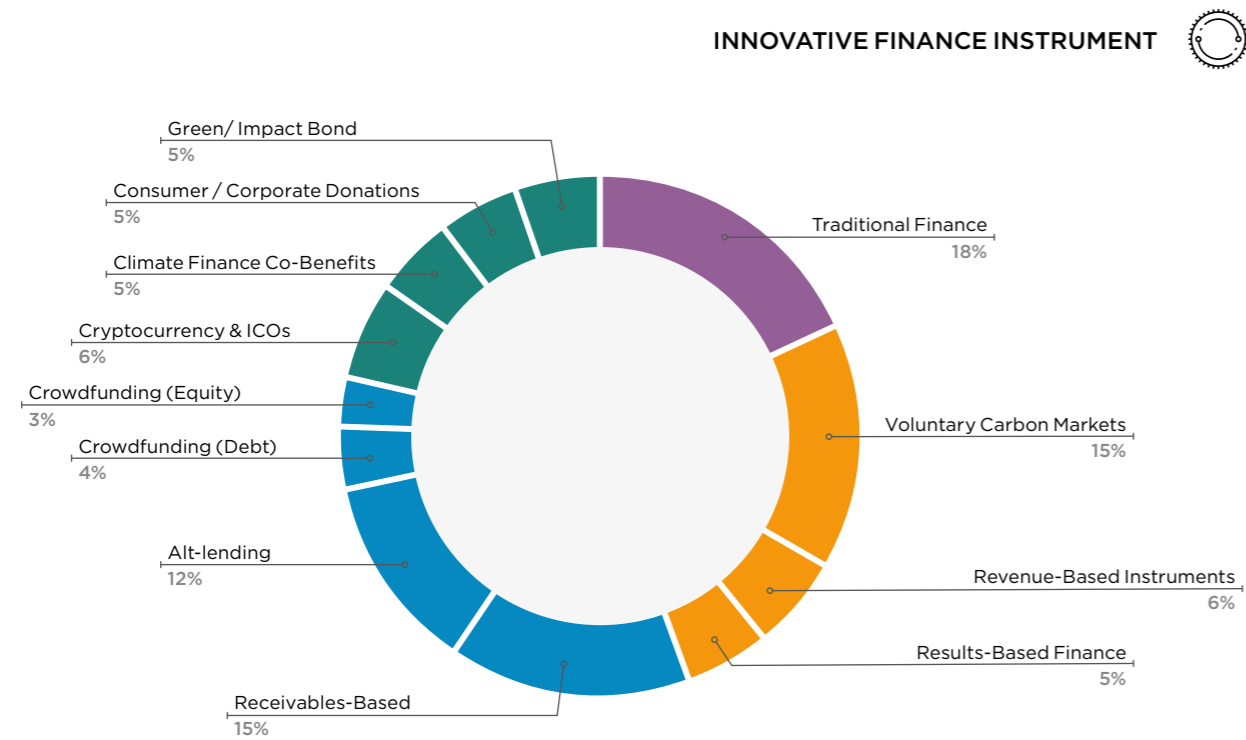
The literature review and interviews identified 11 key categories of innovative finance instruments, nine distinct digitally-enabling technologies, and 10 key transaction mechanisms. Amid the wider set of financial instruments and technologies characterised as 'innovative' in recent years, these have reasonably well-documented real-world applications by utility service providers in the study's geographic focus in the last five years. Working definitions used for each lens and the categories within these are included in the report Annex.

No repository of digitally focused investments into utility service organisations in Sub-Saharan Africa, South Asia and Southeast Asia exists. This study's approach identifies the most significant funding activity across sectors and as a result, begins to build the picture of the ecosystem. While neither comprehensive nor perfectly representative, it provides insight into the relative scale and maturity of the different digitally enabled investment pathways used in LMICs.

Across the landscape of use cases reviewed, several distinct features of maturity emerge. This includes the number of social enterprises accessing a particular instrument, the number of sectors it has been used in, the number of countries, and how many years have passed since the instrument was first used. In terms of associated volumes, features of maturity considered include total investment raised over time and average size of single transaction, deal or announcement.

The remainder of this chapter discusses the key use cases identified by their level of maturity. Mature use cases are better equipped for geographic or sector replicability through commercial capital and profit-oriented partnerships. Scaling use cases require more demonstrations of viability, particularly suited for blended finance models incorporating both concessional (e.g., more impact-oriented) and commercial (e.g., more return-oriented) capital. Emerging use cases require more pilot demonstration and grant capital to reach commercial scale.

Figure 2
Distribution of in-scope financing instruments



Voluntary Carbon Markets
Revenues generated by utility service providers on the basis of the generation and sale of carbon credits through certified (e.g. Gold Standard, Verra, VCS) and proprietary carbon exchange platforms.

Revenue-Based Instruments
Investment mechanisms into utility service providers structured such that returns to investors are a direct function or proportion of revenues collected over a given time period.

Results-Based Finance
Grant disbursements premised at least in part on automated verification of performance indicators through digital verification, for example leveraging sensors or metering data.

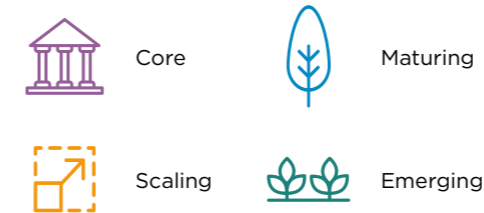
Receivables-Based
Working capital provided by a commercial offtaker like a bank to utility service delivery company in exchange for its portfolio of receivables — customers' loan repayments.

Crowdfunding (Debt/Equity)
Debt or equity funding accessed by utility service providers aggregated through a digital platform from a variety of non-traditional investors (i.e. individuals).

Alt-lending
Investments into social enterprises that lend directly to end-users, leveraging alternative data (alt-data) beyond those employed by traditional banks to make credit-decisions, including mobile money transaction or other telecom data, satellite imagery, and psychometric evaluations.

Notes: The width of each bar represents a single use case. 'Primary' and 'secondary' technologies are included in the middle two columns to capture interactions between combinations of technologies employed in use cases.

MATURITY



Traditional Finance
Venture, impact venture, DFI or commercial seed, equity, debt, grant or blended structure (including mezzanine financing, first-loss guarantees).

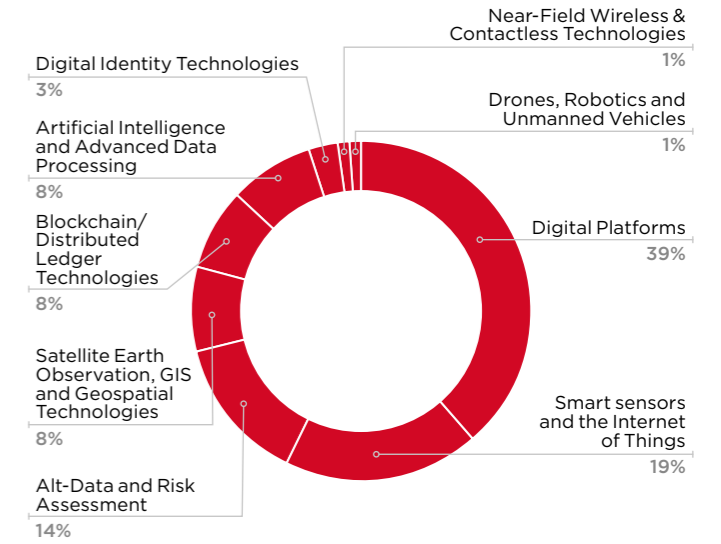
Cryptocurrency & ICOs
Funds raised for utility service provider programmes or operations based on the sale of digital or virtual forms of currency that use cryptography for securing financial transactions, controlling the creation of new units, and verifying the transfer of assets.

Climate finance co-benefits
Price premiums or standalone certificates associated with carbon credits with verifiable social or environmental impacts beyond their emissions impact; for example biodiversity, peace, or gender impacts.

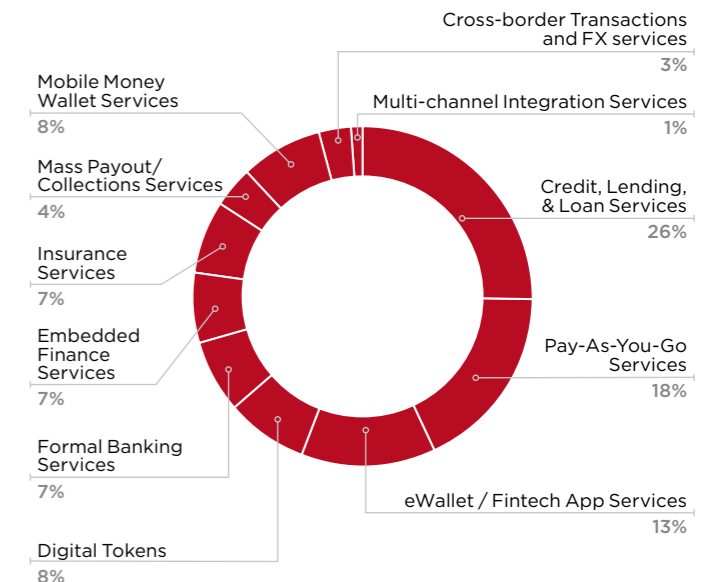
Consumer / Corporate Donations
Funds raised for utility service providers from consumers or corporates embedded in otherwise unrelated commercial transactions; for example where a proportion of the sales price of a product purchase is earmarked for projects with social or environmental impact.

Green/Impact Bond
Bonds that pay periodic interest to bondholders and have a defined maturity date when the principal amount is repaid to the bondholders, wherein proceeds from sale are earmarked for projects with clear environmental benefits like renewable energy, energy efficiency, clean transportation, sustainable agriculture, pollution control and biodiversity conservation.

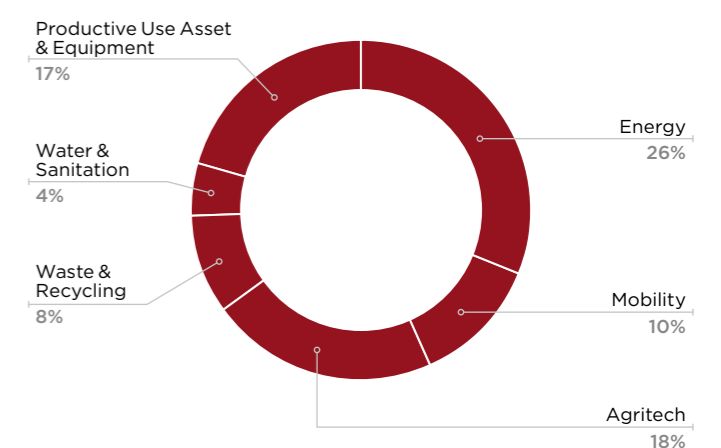
DIGITALLY ENABLING TECHNOLOGIES



TRANSACTION MECHANISMS



SECTOR



2.1 Maturing use cases

The maturing use cases reviewed leverage well-known financial instruments, where digitisation over recent years has unlocked commercial-scale transactions. Technologies including platforms with embedded transaction mechanisms, integrations with satellite data, and IoT data and advanced analytics have crossed the threshold from experimental to commercial viability. The traditional finance mechanisms paired with these include debt and equity round (Seed, Series A, B or even C fundraising). Examples of such use cases are largely concentrated in fintech, and at the intersection of fintech and other verticals such as agritech (as exemplified by **Apollo Agriculture's** \$40 million Series B raise to expand farmers' access to high-quality farm inputs), and energy (as exemplified by **Sun King's** \$260M Series D to widen energy access in Africa and Asia via PAYG).

Lending models reaching maturity based on alternative data are being accelerated by digital technologies. Across Africa and Asia, a variety of data-driven mechanisms for evaluating the needs of various types of businesses have a long history for increasing financial inclusion. Alternative lending models for small businesses have increasingly digitised, with specialists like **Musoni** emerging to automate manual lending and repayment processes, and a growing ecosystem of B2B startups are providing financial services like working capital to SMEs leveraging data and digital technology like **Kippa**¹⁹ or **Sabi**.²⁰ Thanks to increasing smartphone penetration and the

19. PaySpace Magazine (2023). **Nigerian B2B E-Commerce Startup Sabi Raises \$38 Million to Serve African Retailers.**
20. TechCrunch (2022). **Nigerian financial management app for merchants Kippa bags \$8.4M in new funding.**
21. World Bank (2022). **Off-Grid Solar Market Trends Report 2022: State of the Sector.**

Spotlight 3

Asset finance for productive use equipment

Asset-finance models specific to productive use assets such as agriculture equipment are emerging across geographies, but our interviews revealed that traditional models of credit evaluation and loan repayment remain dominant. Refrigeration and solar water pumping models have shown early promise, but additional consumer education is likely needed for PAYG billing models to match the growing range of off-grid appliances at different levels of maturity in the market.²¹ Collectively, asset-specific finance models account for approximately one quarter of the use cases identified in the maturing use case category. Use cases in this group include:

- **EnerGrow** is electrical equipment financing startup based in Uganda. The company works with energy providers such as utilities and mini-grid companies to help customers buy appliances to increase their incomes and grow their businesses. It collects data from a range of different sources, and has an algorithm to establish customer credit scores, and provides loans to business and households for assets or appliances valued between \$50 and \$5,000, over a period between 6 months and 3 years.
- **Aye Finance**, a startup specialising in micro-loans across India, offers financing to small enterprises for productive assets. They employ AI and machine learning technologies to predict creditworthiness through a variety of non-traditional data points.
- **Koolboks** provides PAYG solar-powered refrigeration solutions. Koolboks' innovative product uses ice and batteries to convert the power of the sun into cooling. The company cuts the cost of off-grid refrigeration by 40% and, with embedded PAYG technology, Koolboks are offering their freezers on a lease-to-own basis. A locking device embedded within the compressor links the payments and cooling.
- **CLASP's** Productive Use Appliance Financing Facility, in partnership with **Nithio**, provides procurement subsidies and capacity-building grants to 18 small and medium-sized enterprises selling productive use appliances across Africa.

availability of satellite data, there is now much more data for these models to draw on. The use of satellite imagery to evaluate the quality of farm plots for determining repayment likelihood to farmers has been used by a number of social enterprises, particularly in Kenya and Nigeria, with examples including **Twiga Foods**, **FarmCrowdy** and **Thrive Agric**. Alt-lending models are further explored in a case study in Chapter 3.

Receivables financing has a long history across geographies and is increasingly being used by digital-first startups, with companies using advanced analytics to quantify default risk, drawing on data produced by connected devices. The instrument has seen strong uptake in the Asia-Pacific region over the last two decades,²² driven by regulations favouring the formal banking sector's focus on trade and supply chain finance. The last few years have seen sizable receivables deals for companies targeting first time access to essential utility services. Deals in the off-grid sector have cleared the \$100 million mark in value. For example, **d.Light's** BLK1 and BLK2 receivables finance structures were worth over \$300 million,²³ and **Sun King** has employed a similar arrangement to unlock \$130 million denominated in Kenyan shillings.²⁴ These deals provide the companies with capital to reinvest into expansion, rather than waiting for a slightly higher value to be recouped through customers' small, recurring payments.²⁵

Receivables financing is exhibiting maturity through its application across sectors, particularly in mobility financing. Similarly to the PAYG energy space where granular transaction data facilitates the de-risking of securitised arrangement, in the mobility sector, vehicle-tracking and embedded finance models such as those of **Metro Africa Xpress Inc.**, **MNT-Halant** and **Watu** further limits the risk of default to the entity managing the asset or purchasing the value of receivables. These models are particularly useful to hardware-dependent innovators whose focus on low-income customer bases generates significant balance-sheet lending pressure, like vehicle financiers. Receivables financing models are further explored in a case study in Chapter 3.

Crowdfunding mechanisms are among the most mature sources of innovative finance, though with limited application. Enabled by digital platforms that facilitate the collection and aggregation of funds of various sizes and currencies (typically from Europe), these platforms are principally middlemen for otherwise traditional disbursement mechanisms to pre-identified and vetted projects that have achieved a certain level of scale on the ground. The primary innovation in crowdfunding mechanisms lies in the use of digital platforms for aggregating and disbursing raised funds to enable swifter fundraising than otherwise available from commercial entities.

Despite collectively representing hundreds of millions of dollars for the energy sector in particular, investment amounts for individual companies are typically much smaller, complementing rather than replacing traditional capitalisation activities. Platforms such as **Seedr**, **Crowdcube**, **Trine** and **Energise Africa** are particularly prominent. Initially these platforms were heavily debt-focused; in 2019, 90% of the crowdfunded \$59 million was debt-based. One of the earliest instances of debt crowdfunding was a \$7 million raise by **Bboxx** in 2018 through the **Trine** platform. However, there is a notable shift towards equity investments. For example, in 2023, **Loowatt** raised approximately \$1 million in equity on the **Seedrs** platform for expanding sanitation services in Madagascar.²⁶ The **Energise Africa** platform, a collaboration between **Ethex** and **Lendahand**, stands out as a leading example of innovation in the crowdfunding space. It successfully engaged over 4,000 individual investors, funded over 8,000 micro and small enterprises and smallholder farmers, mitigating over 180,000 tonnes of carbon dioxide a year, and enabled more than 850,000 people across 15 countries to access affordable solar energy.²⁷

22. Trade Finance Global (2023). **After two decades of steady growth, are we at a breakthrough moment for factoring in Asia?**

23. SolarQuarter (2022). **d.light Secures \$50 Million Debt Financing for its Solar Business in Africa.**

24. Sun King (2023). **Sun King and Citi Close First \$130 Million Securitisation to Broaden Access to Finance for Off-Grid Solar in Kenya.**

25. IFR (2023). **Sun King joins effort to expand solar ABS in Africa.**

26. Seedrs (2023). **Loowatt.**

27. UNDP (2022). **Linking Global Finance to Small-Scale Clean Energy.**

2.2 Scaling use cases

Scaling use cases demonstrate early indications of graduating from experimental towards commercial viability. These use cases leverage digital technologies whose application has matured beyond the pilot phase and have found concrete application in at least one or two markets with a demonstrated ability to grow further. Such use cases tend to target a blend of commercial and grant capital, and leverage combinations of technologies in ways that have demonstrable product-market-fit.

Climate finance represents a potential game-changer for innovative financing in the utilities sector. In parallel to mandatory mechanisms for limiting carbon emissions, voluntary markets have in recent years emerged as a viable source of financing for social enterprises. Climate finance in the utilities sector has been driven by clean cooking, where carbon credits now represent roughly a third of sector revenues.²⁸ For example, ENGIE and Salesforce have formed significant partnerships with **ATEC** and **South Pole** for the purchase of certified carbon credits based on the displacement of fossil fuel consumption.

A dynamic, though fragmented, ecosystem of players is emerging across the global climate finance value chain for the digital monitoring and verification (dMRV) of environmental impact. These use cases principally leverage satellite technologies, IoT, blockchain and advanced analytics for verification.²⁹ Limited integration of innovative transaction mechanisms into climate finance has to date represented a barrier on the downstream distribution of climate capital. After fevered growth in the last few years the market has slowed recently. On the buyer side this can be attributed to uncertainty around credit integrity and regulatory changes,³⁰ while in the financial markets macro-trends mean that it is being looked at differently as an asset class.³¹ Nevertheless, climate finance remains an attractive source of capital for social enterprises. Climate finance for social enterprises is discussed in more detail as a case study in Chapter 3.

Revenue sharing models leveraging digital innovations are exhibiting dynamic growth as an emerging model for asset-focused businesses. These models tie repayment of invested capital directly to the revenue of the investee, aligning incentives for cooperation. The novel technological enabler lies in developing high visibility on operations, sometimes in real-time, through asset tracking. This performs a dual function: i) as a securitisation measure, and ii) generating the data needed for credit scoring. Embedded finance

Spotlight 4 KOKO Networks applies climate finance to subsidise the cost of ATM dispensed bioethanol cooking fuel

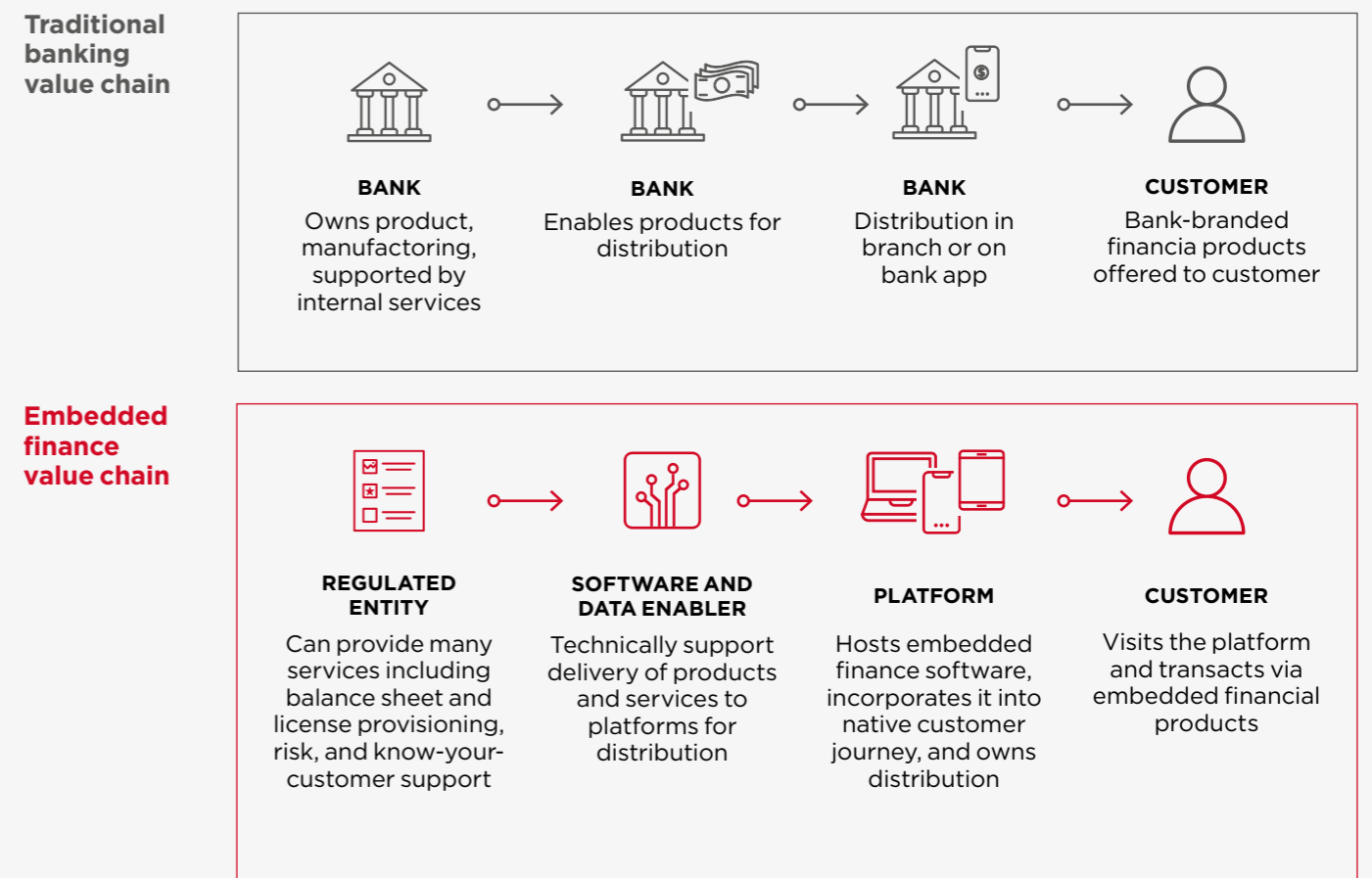
KOKO Networks taps into climate finance to subsidise bioethanol cooking fuel through fuel ATMs in Kenya. Over 300,000 households are currently using KOKO Networks' bioethanol fuel and stove, a 200% growth rate from the previous year. Over the past four years, KOKO Networks has generated over \$100 million in carbon finance through credit sales on compliance markets in South Korea, with plans to expand to Singapore and Japan in coming years. Rather than treat funds generated as extra revenue, KOKO Networks returns value to customers as subsidies, reducing the cost of a stove by 85% and fuel by 25-40%, making it far more accessible to households.³² The technology stack that facilitates these operations include:

- Electronic cards: Shop owners use KOKO's PoS to sign-up customers and issue electronic cards linked to e-wallets, facilitating purchases from KOKO Club shops
- Flexible payment options: Customers can top up their e-wallets using mobile money and other technologies
- Efficient inventory management: Real-time management prevents stockouts and provides accurate market analytics

technologies (Figure 2) that enable the automatic deduction of a portion of revenue or sales are a critical enabler of revenue sharing models on the transactions side. For example, vehicle financing provider **Moove's** model is based on a portion of driver revenue being automatically diverted from the rider-to-driver's e-wallet to cover car repayments.

28. Clean Cooking Alliance (2022). *2022 Clean Cooking Industry Snapshot*.
 29. World Bank (2022). *Digital Monitoring, Reporting, and Verification Systems and Their Application in Future Carbon Markets*.
 30. Bain & Company (2023). *Voluntary Carbon Markets in 2023: A Bumpy Road Behind, Crossroads Ahead*.
 31. S&P (2023). *What lies ahead for voluntary carbon markets in 2023*.
 32. Financial Times (2023). *Start-up taps carbon markets to boost clean cooking in Africa*.

Figure 3
How embedded finance works



Source: Bain (2022)

Early pioneers of this embedded finance model include SuperApps like Grab and Gojek in Indonesia, leveraging their diverse ecosystem of app-based ecommerce and mobility offerings.³³ These models, in turn, follow **Tencent's** WeChat in China, which pioneered embedded digital payments with Alipay in 2011.³⁴ SuperApp models that lend themselves to revenue sharing models are expanding faster in Africa and Asia than in Europe and North America, despite the latter's more advanced digital ecosystems.³⁵ Further exploration of revenue sharing models is considered as a case study in Chapter 3.

RBF instruments are slowly beginning to digitise. RBF mechanisms can act as a form of subsidy that have attracted renewed attention for the achievement of energy access targets via standalone systems and increasingly, decentralised grid connections. Historically oriented as a mechanism for governments and development funders to drive transparency, efficiency, and innovation to accomplish a range of socio-economic outcomes, recent iterations of RBF have been demonstrated by projects that provide funders with automated metrics of performance based on IoT connected devices and verification within analytics-enabled digital platforms. Digitally verified RBF instruments are considered as a case study in Chapter 3.

33. Alviere (2023). *Grab a seat at the Embedded Finance table*.
 34. CGAP (2019). *China: A Digital Payments Revolution*.
 35. Economist Impact (2022). *The super-app model in the Middle East and Africa*.

2.3 Emerging use cases

Emerging use cases are those where commercial finance remains elusive or poorly matched to the challenge. Emerging use cases are largely at the development and pilot stages, aiming to demonstrate their viability for commercial capital, but dependent on grant funding to get there. It is within these use cases that we find the novel use of frontier technologies, including embedded smart contracts, the more nascent AI applications, and the integration of drones and robotics. Ticket sizes for these deals were under \$1 million, and development finance institutions (DFIs), philanthropic and corporate donors are the most common funders. One such example is the **ixo Foundation's** smart device and blockchain-based Development Impact Bond pilot sponsored by UBS in India, which focussed on collecting verified claims data and integrating this with smart contract triggers, providing performance tracking.³⁶

The emergence of social and environmental co-benefits monetisation is emerging in tandem with climate finance. Such impact credits mirror climate finance mechanisms but quantify social impact rather than mitigation or sequestration of carbon emissions. Additionally, co-benefits are increasingly monetised with carbon credits by adding a price premium on existing climate credits issuances.³⁷ Recent research indicates co-benefits confer an estimated price premium between 6.6% and 29%.³⁸ Satellite and blockchain technologies have been particularly critical to nature-based environmental services that fall under the co-benefits category, for example mangrove or no-till soil conservation. Co-benefits monetisation considerations are briefly considered as part of the climate finance case study in Chapter 3.

Relatively few use cases of digitally enabled impact bonds were identified in the landscape targeting utility service providers. Such impact bonds share many features with RBF, with a key difference being that projects tend to be funded upfront by a third party, with repayment at least partially conditional on achieving specified outcomes. Few explicit applications of digital technologies were identified in the landscape review, though a notable example is the 'In Their Hands' initiative implemented by **Triggerise**. In this programme, adolescent girls are rewarded for adopting sexual health behaviours through discounts and vouchers in a dedicated app, including voice-activated biometric identification. The growth of such nascent financing models is dependent on government-led public-private collaborations, building on learnings from successful socially oriented interventions, like reducing recidivism among recently released prisoners.³⁹

Digital tokens and cryptocurrency-based models provide emerging examples of innovation focused on the last-mile. These examples tend to be cross-cutting, as they leverage the immutable properties of distributed ledgers to imbue various kinds of alt-currencies or tokens with value that can be exchanged or redeemed in a multitude of ways. Use cases identified in the landscape include **Fishcoin**, generating a proprietary cryptocurrency that rewards members of global fishing supply chains for contributing data on sustainable fishing practices to the chain; **Powerblocks** and **Gridless**, aiming to install bitcoin mining assets on excess-electricity producing mini-grids; **Sun Exchange**, leveraging the Initial Coin Offering crypto mechanisms to sell fractional returns on cross-border panel installations; and **Jia**, offering loans to SMEs who receive tokens after repayment that they can later redeem at a rate agreed upon based on Jia's profits.



36. Frontier Technology Hub (2019). [Connecting Finance to Results: Can Emerging Technologies Make Impact Bonds More Impactful?](#)

37. ASEAN Low Carbon Energy Programme (2022). [Integrating a Gender Lens in Voluntary Carbon Markets Volume II. Main Report.](#)

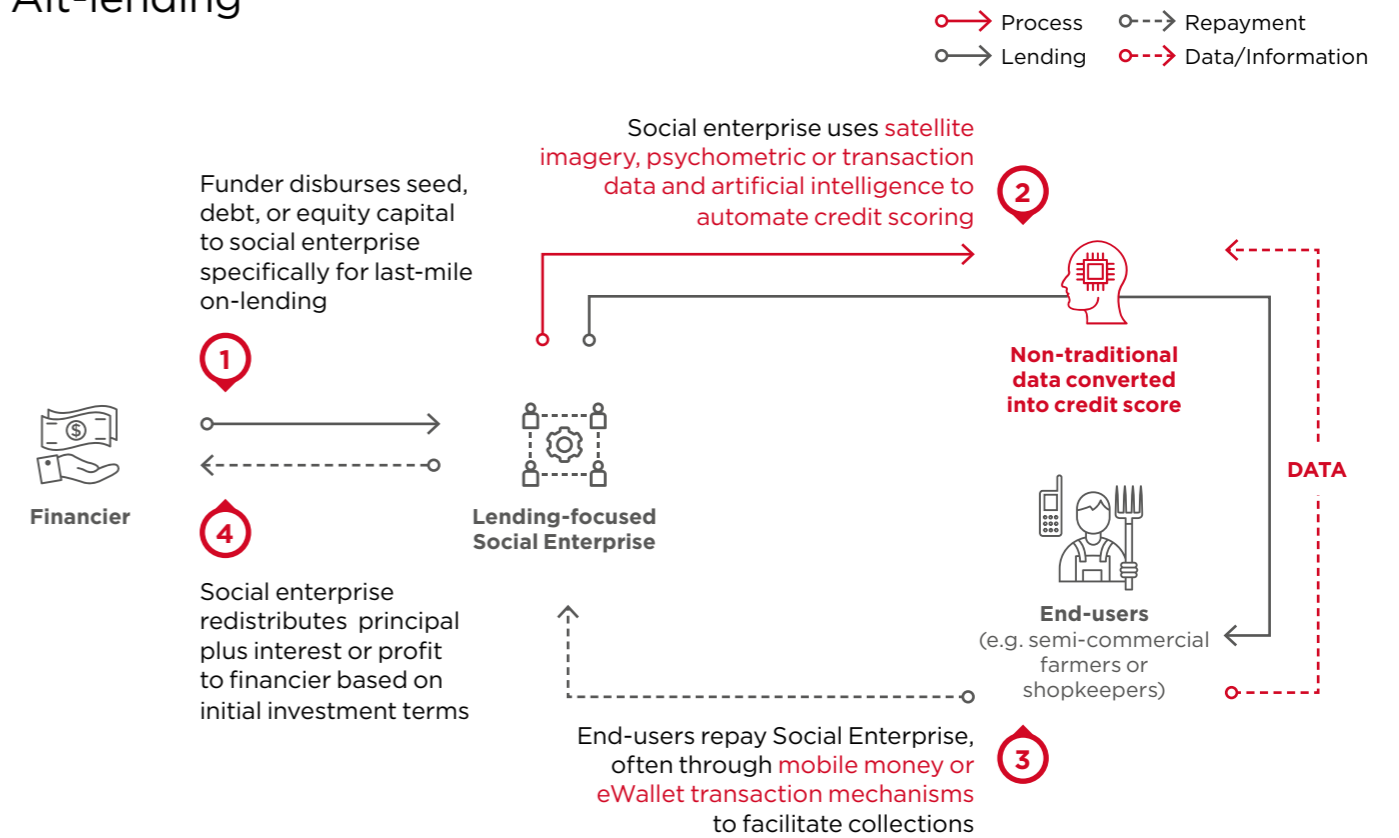
38. Lou, J. et al (2022). [Integrating sustainability into climate finance by quantifying the co-benefits and market impact of carbon projects.](#) Nature.

39. Social Finance (2021). [Three insights for using impact bonds to scale social enterprises.](#)



Figure 4

Alt-lending



3.1 Alt-lending

Alternative lending or ‘alt-lending’, in the context of innovative financing, refers to non-traditional methods of providing funds outside of traditional financial institutions. Alt-lending often involves utilising technology, data analytics and other creative strategies to assess creditworthiness and facilitate lending. Alternative lenders often use a wide range of data sources to assess a borrower’s creditworthiness. Examples of these include social media activity, transaction history and other non-traditional data points like psychometric assessments.⁴⁰

The majority of alt-lending use cases identified by this research were in agritech and fast-moving consumer goods (FMCG) sectors. In agritech, these include input finance for fertiliser and seeds and equipment finance for larger assets like rotors and mills. For consumer goods, small kiosks for potable water, phone charging, or other utility-like services were the dominant cases. Small businesses operating these services need to access capital to build, maintain, and expand the inventory required to provide these services. Alt-lending builds from microfinance and the work of Grameen Bank and BRAC, who demonstrated that

lending small amounts to poor clients, particularly women, could successfully yield repayment rates up to 95%.⁴¹ Importantly, this was achieved without any legal contract and based on trust, peer monitoring and collateral substitutes such as credit denial in the event of default. In the ensuing decades, digital technologies have gradually created alternatives to deep personal connections for making informed lending decisions, driven by improved mobile and digital payment infrastructures across emerging markets.

Some of the principal challenges confronting alt-lending are regulatory hurdles related to responsible lending practices, data privacy and anti-money laundering. While innovative data sources and analysis have enabled lending to individuals and businesses with limited credit histories, the long-term accuracy of these models depends on the predictive capacity of algorithms and their suitability to different market contexts, as well as the level of credible data that can be derived from potential borrowers. Challenges to further expansion of alt-lending concentrate on

40. FIIB Business Review (2020). *Resurgence of an Ancient Idea? A Study on the History of Microfinance.*
 41. Finance Magnates (2023). *The Rise of Alternative Lending and Crowdfunding Platforms in Africa.*

the development of appropriate financing tools for specific organisations and sectors, and a lack of expertise at the social enterprise level to build innovative credit models and either the inability or unwillingness to absorb credit risk. Identifying the right size of loans demanded requires a sector-by-sector consideration for the development of appropriate working capital. Given the ease and speed with which loans can be obtained, borrowers risk falling into debt traps or receiving poor credit scores. Interviews for this research found that the ideal ticket size for many of the alt-lending use cases for utility service providers is below \$10,000. Other challenges include lack of regulation, platforms' limited ability to perform due diligence on borrowers, and limited recourse in case of default.⁴²

A key opportunity to scale alternative-lending lies in decentralising credit scoring tools and decisions. Digital tools for making credit decisions remain siloed across different methodologies and players. Mechanisms for capturing alternative data to facilitate credit decisions will be key. Decentralising the sources of finance themselves represents another opportunity, as alt-lending as a category frequently includes platform and peer-to-peer crowdfunding mechanisms. Platforms like [Zidisha](#) and [Lendable](#) are demonstrating the power of the crowd to source finance for projects both internationally and domestically.

The role of digital

Digital technologies that collect and analyse data are the key enablers of alt-lending, which leverages advanced algorithms to assess creditworthiness. This includes machine learning and AI for predictive analytics, computer vision based on satellite imagery, and data visualisation tools and platforms. Additionally, the wealth of transaction data that are generated from digital payments or app-based services are key data points for assessing creditworthiness. As these technologies continue to evolve, alternative lending will be increasingly better positioned to adapt and offer more inclusive, efficient and personalised financial solutions to untapped segments.

Alt-lending models for farming are increasingly paired with farmer advisory services bundled with market exchange and insurance mechanisms. [Apollo Agriculture](#) uses satellite imagery paired with AI to assess farmer creditworthiness, a model that is gaining traction and replication across markets. More advanced use cases spanning global value chains leverage QR codes and blockchain for supply chain transparency as well as AI for automated lending decision-making,⁴³ with niche use cases also employing personality-based psychometric tests for unlocking automated lending to entrepreneurs.⁴⁴

Spotlight 5 Data-driven lending attracts tech-focused investments

Yellow is a South Africa-based solar energy and digital devices asset financier that invested in creating a 'digital twin' of its entire business over the past five years. Digitising every aspect of their business enabled them to outsource and gamify credit-making decisions to sales agents, boosting sales productivity by 300%. This data-driven approach has been instrumental in their recent \$14 million Series B fundraise, and \$45 million in total, from tech-focused impact investors. The growing prevalence of low-million dollar investments for IoT-enabled, data-driven cold-chain solution providers like [Figorr](#) and [Koolboks](#) suggests an increasing appetite from investors to fund social enterprises able to translate digitalisation into operational excellence—particularly as new data facilitates industry benchmarks and KPIs for data-driven portfolio quality management.⁴⁵

Alt-lending leverages a variety of digital technologies to solve lending friction points along operations, risk assessment and transaction facilitation. Where digital wallets and payment services are already used, it creates pathways for companies and customers to access and use digital credit services. These can be enabled to analyse an organisation's cash flow and payment history, sometimes augmenting this information with other signifiers like market dynamics and seasonal patterns. These combinations enable mechanisms for providing trade, asset or inventory financing to utility service providers, whether through automated loan disbursements, Buy Now Pay Later schemes, or upfront asset-lending.

42. Finance Magnates (2023). *The Rise of Alternative Lending and Crowdfunding Platforms in Africa*.

43. See: <https://cloud.google.com/customers/dimuto> (accessed 15 September 2023)

44. TechCabal (2021). *Unconventional Capital is living up to its name with its algorithm-backed investments*.

45. Khaki, N. et al. (2021). *PAYGo Perform: Financial, Operational, and Portfolio Quality KPIs for the PAYGo solar industry*. CGAP Technical Guide.

Key opportunities

- **Advanced risk assessment models using machine learning and AI can enable better lending decisions by analysing a broader range of data points, leading to more accurate predictions of behaviour and default risk.** Increased data availability from IoT devices, sensors, satellites, and smartphones provide the opportunity to gain deeper insights into habits and creditworthiness, lowering the investment risk. Psychometric evaluations are also gaining traction as a way to create new opportunities for lenders to bank thin-file customers.⁴⁶
- **Open banking, APIs and other data-sharing ecosystems can enable faster access to transaction and financial data directly from mobile operators and banks to enhance data availability and loan generation.** These platforms hold the greatest potential to speed up

deployment by automating the lending process from loan application to approval, and document verification and fund disbursement. A number of alt-lenders' key value proposition for borrowers is the fast turnaround on automated credit decision analytics, often on the order of 24-48 hours.

- **Digital platforms can generate insights from transaction data that helps lending platforms refine their sector-specific strategies through data-driven insights.** As more data is collected within a specific sector utility, a track record can be established, lowering the risk profile of certain projects across specific utilities sectors. Digital credit applications can further adjust their default risk models and conditions to account for MSE owners' sectoral contexts (e.g., seasonal volatility in agriculture), customer behaviour (e.g., extended invoicing cycles), or the local financial system (e.g., conditions offered by banks).⁴⁷

Spotlight 6 How economic identities facilitate lending to smallholder farmers: The case of Rural Loan in Papua New Guinea

"Rural Loan" is an earnings-based loan product that farmers can apply for on their doorstep, without putting up any collateral. Instead, it uses farmer data generated by a digital agriculture procurement app to create economic identities for farmers and a credit scorecard for financial service providers (FSPs) to assess risk. Farmers can then use the funds to hire labour, diversify their income, buy new tools or cover non-farm expenses, such as school fees.

The three companies behind Rural Loan are vanilla procurement company and exporter [Kamapim](#), Papua New Guinean microfinance institution [MiBank](#) and agritech company [Field Buzz](#). [Kamapim](#), which has been working with smallholder vanilla farmers in Madang Province since 2018, sends field agents into rural areas of Papua New Guinea to collect farmer and farm and customer data using a mobile-enabled [Kamapim-Field Buzz](#) app and registers farmers on the platform. Once registered, [Kamapim](#) field agents can offer farmers extension support and digital and financial literacy training, generate a government approved identification card, procure farm inputs, sell them a mobile phone, open a bank account and extend a loan.

Collecting and analysing farm and farmer data through the [Kamapim-Field Buzz](#) app allows FSPs to gain insight into farmers' production and financial lives, lowering the perceived risk of default, a major concern for FSPs. The cost of serving smallholder farmers has also lowered through leveraging the assets of [Kamapim](#), particularly the field agent network and the mobile app. The GSMA AgriTech programme, under the Improving Access to Credit for Farmers in Papua New Guinea initiative funded by Australia's Department of Foreign Affairs and Trade, has been working with consortium partners to design and implement the Rural Loan product. You can read more in a full case study published [here](#).

46. Alibhai, S. et al. (2019). *Disruptive Finance: Using Psychometrics to Overcome Collateral Constraints in Ethiopia*. World Bank.

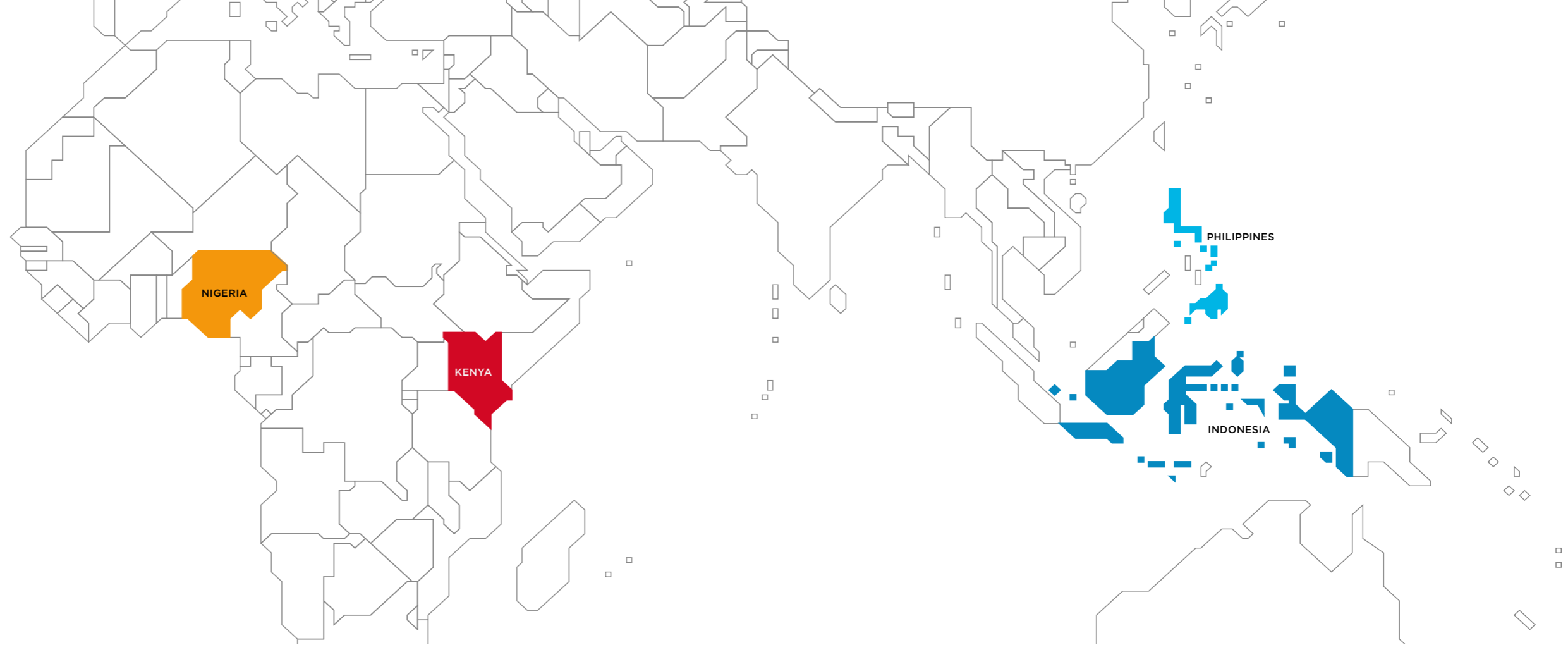
47. Strive Community (2022). *The digital transformation of small business support*. Mastercard Center for Inclusive Growth.

NG

TradeBuza uses satellite imagery, cloud management platforms and APIs to support smallholder finance

TradeBuza aims to facilitate farmers' access to financing through its robust technological and data infrastructure. In addition to offering creditworthiness assessment data for lenders, TradeBuza introduces three primary tools: 'Capture' for GPS farm mapping and collecting farmer KYC details, 'AgroAPI' for remote sensing and satellite imagery, and 'Agro'—a cloud-based farm management platform.

- DIGITAL PLATFORMS, SATELLITE EARTH OBSERVATION, GIS AND GEOSPATIAL TECHNOLOGIES, ALT-DATA AND RISK ASSESSMENT
- MASS PAYOUT/COLLECTIONS SERVICES
- AGRITECH



NG

Crop2Cash provides input financing to smallholder farmers based on satellite imagery

Crop2Cash provides input financing to smallholder farmers. Its operating system for agricultural lending aims to unlock billions in finance for farmers. Their system enables financial institutions to make credit decisions about farmers by just knowing the farm GPS coordinates. Crop2Cash offers simple financial accounts linked to an e-wallet where farmers can receive payments, make purchases and track their financial transactions. The system runs on USSD, making it accessible to farmers who don't have a smartphone.

- DIGITAL PLATFORMS, ALT-DATA AND RISK ASSESSMENT, DIGITAL IDENTITY TECHNOLOGIES
- CREDIT, LENDING, & LOAN SERVICES, E-WALLET / FINTECH APP SERVICES
- AGRITECH

NG

ThriveAgric provides input finance to farmers based on a digital platform for tracking performance and analysing credit

ThriveAgric, with over \$100 million invested in 514,000 smallholder farmers across Nigeria, Ghana, and Kenya, focuses on scaling food production using tech solutions, including their 'Agricultural Operating System'. Their services encompass input financing, facilitated by assessing farmer creditworthiness using onboarding data, supply chain efficiency, and sustainable agricultural practices, alongside farm monitoring, advisory services, and post-harvest inventory management. Recently, the startup secured \$56.4 million in debt financing, inclusive of a \$1.75 million grant from the USAID-funded West Africa Trade & Investment Hub.

- DIGITAL PLATFORMS, ALT-DATA AND RISK ASSESSMENT
- CREDIT, LENDING, & LOAN SERVICES
- AGRITECH

NG

Intelligra provides smartphone financing solutions to consumers and uses MNO data for alternative credit scoring

Intelligra is an open platform for smartphone financing. The company has entered a non-exclusive partnership with MTN in Nigeria and Rwanda. In both markets, it uses mobile network operator data, subject to regulatory & privacy constraints, to develop smart, alternative credit scores. It also uses MTN's existing subscriber base and subscriber acquisition efforts for distribution to lower its own customer acquisition costs.

- LENDING
- MOBILE DATA
- SMARTPHONE FINANCING

KE

Apollo uses satellite imagery data of farms and AI to rate the creditworthiness of farmers

Kenyan agritech firm, Apollo Agriculture, aims to double its farmer clientele by the end of 2022 and offer more value-driven products, following a \$40 million Series B funding led by Softbank Vision Fund 2. Utilising satellite imagery and AI to determine farmers' creditworthiness, Apollo will invest in enhancing its technology and expanding its offerings. Since its 2016 launch, the startup has grown by collaborating with agents who onboard farmers and retailers to its platform.

- DIGITAL PLATFORMS, SATELLITE EARTH OBSERVATION, GIS AND GEOSPATIAL TECHNOLOGIES, AI AND ADVANCED DATA PROCESSING
- INSURANCE SERVICES, CREDIT, LENDING, & LOAN SERVICES
- AGRITECH

KE ID

Jaza Duka applies credit scoring to Unilever transaction data to unlock SME finance

Mastercard has expanded its Jaza Duka initiative, originally launched in Kenya with Unilever and Kenya Commercial Bank (KCB), to support Indonesian micro-retailers. By analysing purchase data from Unilever, Mastercard evaluates micro-retailers' creditworthiness, enabling KCB to offer short-term credit via Mastercard's mobile payment platform. Since its 2017 inception, over 12,000 micro retailers have enrolled with a 97% repayment rate. Additionally, they experience a 20% sales increase post-training in inventory and credit management by Mastercard. Recently, the digital retail platform Kasha joined Jaza Duka, adding 5,000 MSMEs to the programme, further aiding micro-entrepreneurs to overcome financial constraints and boost their businesses.

- DIGITAL PLATFORM, ALT-DATA AND RISK ASSESSMENT
- CREDIT, LENDING, & LOAN SERVICES, E-WALLET / FINTECH APP SERVICES
- PRODUCTIVE USE ASSET & EQUIPMENT

PH

Growsari's app enables kiosks in the Philippines to access discounted goods from FMCG multinationals

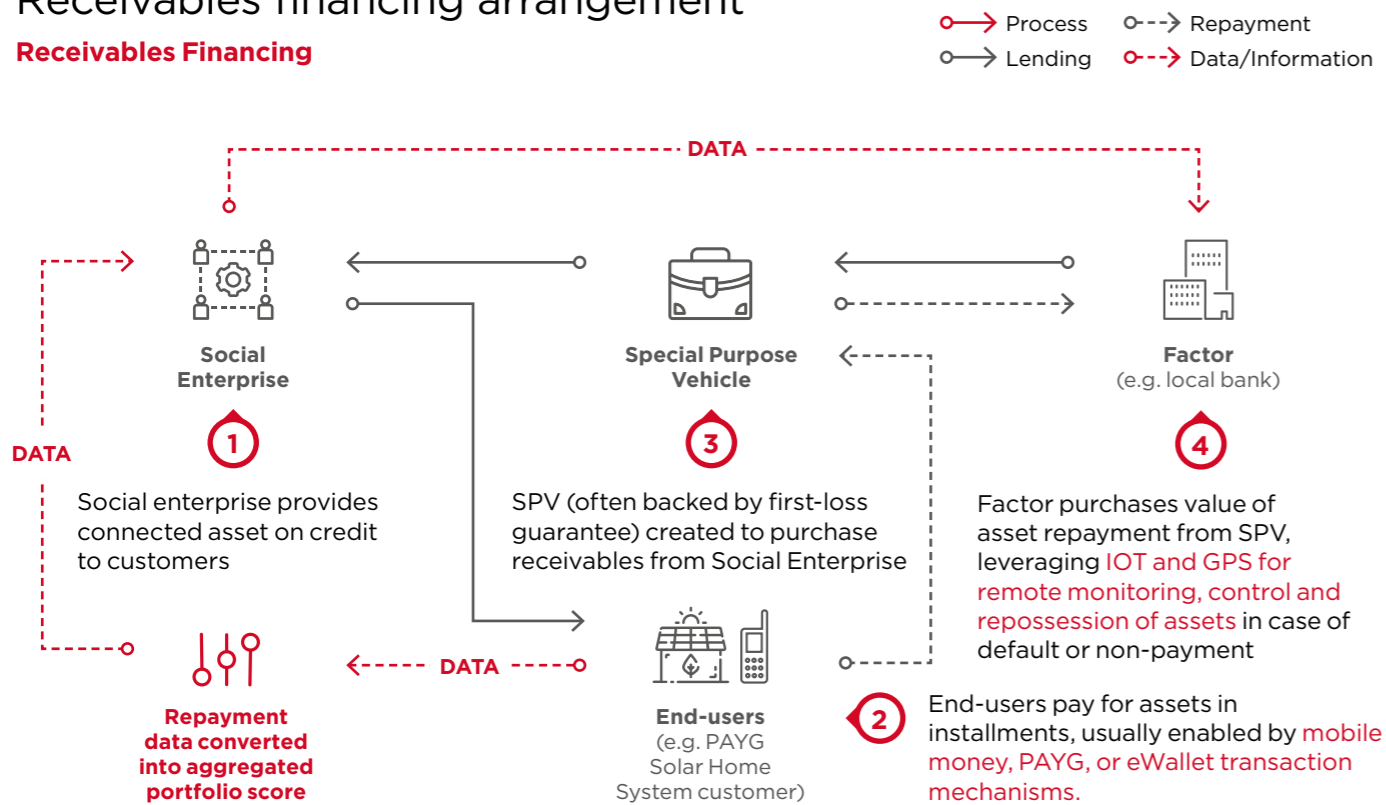
Growsari is a startup that is digitising sari-sari stores in the Philippines with features like pricing tools, inventory management and working capital loans. Growsari says it can give sari-sari store operators better pricing for products from FMCG brands, including Unilever, P&G and Nestlé, which it claims can help stores double their earnings. Other services in the app include online telecom and utility bill payments, remittance and microfinancing for working capital loans. It recently announced it has raised a Series B from several notable investors that brings its total funding to \$30 million. The startup is part of a new crop of B2B platforms in Asia focused on serving micro to small-enterprises, including BukuWarung and BukuKas in Indonesia and Khatobook in India.

- DIGITAL PLATFORMS
- CREDIT, LENDING, & LOAN SERVICES, CROSS-BORDER TRANSACTIONS AND FX SERVICES, INSURANCE SERVICES
- URBAN FMCG SMES

Figure 5

Receivables financing arrangement

Receivables Financing



3.2 Receivables financing

Receivables financing is a financial method where businesses use their outstanding invoices as collateral to secure immediate cash from lenders or financial institutions. These institutions, also known as ‘factors’, buy the right to collect a firm’s invoices from its customers by paying the firm the face value of these invoices, minus a discount. The immediate access to cash sellers makes factoring an essential financing instrument for organisations offering physical assets to low-income customers on credit.

Global growth in receivables financing has been driven by momentum in trade and supply chain finance, with limited but growing applications in the utilities sector. Though best suited for asset or goods-focused operations, receivables financing has also been a financing instrument for infrastructure projects across LMICs. Examples include toll roads and airlines in Indonesia, water and electric utilities in Brazil, and transport, water, waste and energy equipment in China.⁴⁸ The total value of factoring was over \$24 billion in Africa in 2019⁴⁹ and projected to reach \$50 billion by 2025.⁵⁰ At present, it is overwhelmingly concentrated in South Africa and North African countries.

A notable exception are PAYG solar companies like M-KOPA, Bboxx and ZOLA Electric, who have engaged in increasingly large receivables financing arrangements over the past five years. By collateralising receivables and isolating operator risk through off-balance sheet financing structures, these PAYG companies have been able to tap into local financial markets. At the same time, they have isolated lenders from the operational and market risks associated with selling products based on credit to a low-income customer base with seasonal/irregular income streams.⁵¹ This decoupling of the retail and distribution value chain allows debt investors to effectively isolate receivables risk and allow for more rapid and sustainable paths to scale.⁵² Receivables financing could be transformational to PAYG solar businesses and support the expansion of a wider range of PAYG use cases, as exemplified by M-KOPA’s recent funding for PAYG smartphones and e-mobility solutions.

48. Harwood, A. (2021). *Accelerating Securitization in Africa to Finance the SDGs: Future Flow Securitizations*. Milken Institute.
 49. The African Capacity Building Foundation (2021). *Factoring in Africa to Support Trade Development: Challenges and Opportunities for Growth through Capacity Development*.
 50. Ibid.
 51. Africa Energy Portal (2019). *Unlocking receivables-backed financing in the off-grid solar sector in Africa*.
 52. Waldon, D. et al. (2018). *Taming the Strange Beasts: Servicing and the Future of PAYGo*. CGAP Working Paper.

In Asia, demand for receivables financing is growing at an average of 7% annually,⁵³ but is similarly concentrated in a few key markets (Singapore, Thailand and Malaysia)⁵⁴ and dominated by formal banks and large corporations.⁵⁵ This dynamic is poised to change, however, as lending focused fintechs are aggressively targeting attractive niches.⁵⁶

Barriers to accessing receivables financing include limited awareness, regulatory issues, high costs, policy inconsistencies, and lack of data on receivables financing deal flows and activities. A key enabler for addressing these issues is the participation from DFIs. The US Development Finance Corporation and British International Investment were both instrumental in supporting securitisation deals. Guarantee mechanisms are particularly critical to support local currency financing by incentivising the involvement of local banks.^{57,58} Investors across the impact-return spectrum may also gain additional interest in the model, drawn by the growing body of evidence around the impacts for low-income customers.⁵⁹

Digital technologies supporting receivables finance face questions with respect to accessibility and fairness. Most financing remains accessible only to established organisations with developed digital infrastructure, and the proprietary nature of risk-scoring methodologies limits accessibility for smaller enterprises. Further ethical issues arise when lending controllable assets to low-income groups, especially when defaults leads to the seizure of those assets.

The role of digital

The principal contribution of digital technologies is the data they produce, including the granular payment data from digitally enabled assets and wallets. For example, PAYG systems rely on M2M communication, where devices remotely relay consumption data to a central server, predominantly via GSM. The wealth of repayment data from these business models has allowed for the creation of portfolio-level credit scores, facilitating the ease of sales to factors and subsequently liberating working capital.

IoT, in conjunction with asset tracking, serves as the foundation for receivables models tailored for mobility solutions. Geolocation capabilities are critical for effective securitisation of mobile assets such as vehicles. Additionally, mobility use cases leveraging app-based rider-driver matching platforms pave the way for further innovative transaction types, from automated credit lending to e-wallets to the integration of embedded finance.

Aggregation, data standardisation and automated transaction tracking can further address challenges in the deployment of receivables financing capital. Receivables financing data has yet to be standardised in the utilities sector, reducing investors’ incentives to carry out complex asset analysis. High transaction costs make small deals less attractive, creating barriers to entry for smaller distributors. Aggregation of upstream capital devoted to receivables financing, as well as downstream aggregation of eligible projects, is poised to increase its accessibility and attractiveness to a wider set of players.⁶⁰ Solaris Offgrid, for example, is developing the Bridgin receivables aggregation platform that integrates with all major PAYG management platforms. This enables increased automation of data collection, aggregation and transaction processing, reducing transaction costs overall.⁶¹

53. HSBC (2023). *Global Supply Chains – Networks of Tomorrow*.
 54. OECD (2020). *Alternative Financing Instruments for ASEAN SMEs*.
 55. Ibid.
 56. Botta, A. et al. (2020). *Supply-chain finance: A case of convergent evolution?* in The 2020 McKinsey Global Payments Report (2020). McKinsey.
 57. The African Development Bank (2020). *Exploring the Role of Guarantee Products in Supporting Local Currency Financing of Sustainable Off-Grid Energy Projects in Africa*.
 58. Impact Alpha (2023). *Big Solar: D.light securitizes customer loans as incumbents consolidate off-grid energy market*.
 59. Kumaraswamy, S.K., et al. (2020). *Assets Matter to Poor People - But What Do We Know about Financing Assets?* CGAP Working Paper.
 60. Aidun, C. et al. (2023). *Is It Time for a Solar Receivables Finco?* Persistent Energy.
 61. PayGoOps (2023). *Receivables Finance: Powering the Paygo Sector with Liquidity Solutions*.

Spotlight 7 Nithio harnesses satellite imagery coupled with AI and blended finance to make receivables financing more accessible

Nithio, an offshoot of geospatial analytics firm Fraym, directly finances clean energy enterprises in Africa, facilitated by The Shell Foundation. Its 'Servicer of Last Resort' ('SOLAR') financial solution enables it to increase access to receivables financing for smaller solar distributors by mitigating the default risk incurred by investors in an asset-backed securitisation (ABS). It does this by valuing and taking over the servicing of a portfolio of receivables in case the company fails. This ensures that all involved benefit; the receivables can continue to be serviced sustainably, energy customers do not lose access to their products, and investors are repaid.

Nithio's Risk Analytics Engine calculates the real value vs. the face value (contracted) of a ring-fenced receivables portfolio on a discounted basis by directly accessing the CRM systems of distributors. AI helps process this raw, anonymised customer repayment data, which is then combined with a rich database of geospatial socioeconomic, demographic, and climate data. The resulting predictive valuation can then facilitate a structured repayment or ownership transfer scheme in case the distributor fails. Such an approach enables subsidies, grants and concessional funding to support the deployment of receivables finance to distributors that would otherwise not be eligible for such solutions.⁶² Nithio currently oversees \$26 million in funds, with ambitions to escalate beyond \$100 million by 2025.

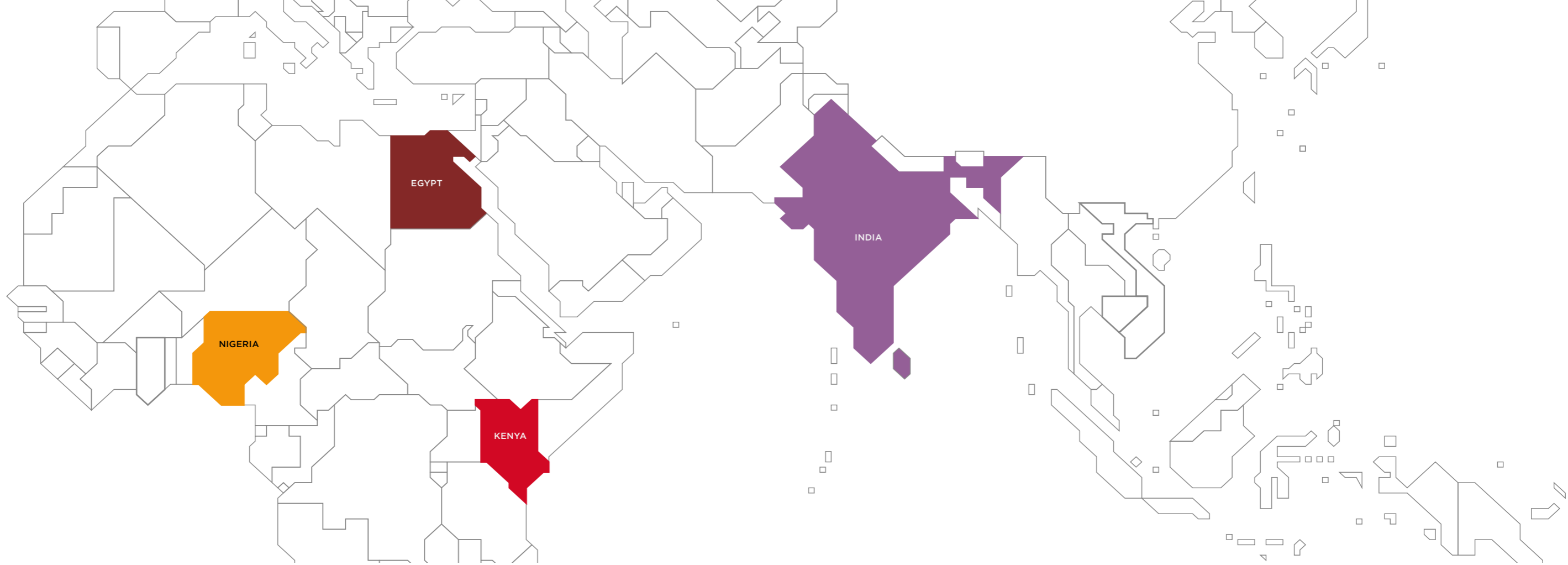
Key opportunities

- **Wider accessibility of portfolio credit scoring methodologies could significantly accelerate the deployment of receivables financing.** As risk analysis standards and processes become more transparent through digital, local banks aiming to penetrate rural customer segments may gain interest in offering financial services to smaller distributors leveraging easy to capture customer data.
- **Larger volumes of working capital can be unlocked as customer relationship management (CRM) software solution adoption becomes more accessible to early-stage companies across a range of different use cases.** Digitising invoices holds promise for increased availability of receivables financing for utility service social enterprises. The availability of CRM software in the utilities space (such as Angaza and PaygOps) offers opportunities to automate routine processes, unlocking larger volumes of receivables financing.
- **Digital platforms aggregating larger volumes of assets can expand the scope of receivables financing across sectors.** Platforms leveraging application programming interfaces (APIs) with IoT-connected devices and predictive analytics could generate first-approximation credit scores to test the application of receivables finance in sectors where it is less common. Clean cooking, productive use assets like solar water pumps, or agro-processing could be securitised in such a way. An emerging example is EnerGrow's productive use asset lending model in Uganda.
- **Satellite based analytics hold promise for expanding the scale of receivables financing to more remote geographies.** These are especially relevant for unlocking asset-backed financing in sectors like agriculture, where fulfilling equipment needs along appropriate repayment cycles can result in appreciable improvements in yields and social impacts. By enabling cross-country comparative benchmarks, these technologies can also support market entry of international receivables financing actors into new or challenging countries.



62. Global Innovation Lab for Climate Finance (2021). *Data-Driven Energy Access for Africa*.

63. Making Finance Work for Africa (2020). *Receivables Finance: Innovative approaches to unlocking Access to Finance for African SMEs*



NG

Metro Africa Xpress Inc pioneers receivables-backed bond issuance for vehicle finance in Africa

Founded in 2015, MAX.ng is a mobility service linking users to professional motorcycle-taxi drivers through an app. MAX.ng has recently collaborated with DLM Advisory to issue fixed-rate notes under an NGN 10 billion (\$13 million) bond programme, marking pioneering moves in vehicle finance asset securitisation in Sub-Saharan Africa. This bond initiative, aimed at supporting MAX.ng’s expansive asset financing across various vehicle classes in Africa, integrates technology to streamline payments between customers, drivers, and the platform’s financing partners.

- DIGITAL PLATFORMS, SMART SENSORS AND IOT, ALT-DATA AND RISK ASSESSMENT
- EMBEDDED FINANCE SERVICES, CREDIT, LENDING & LOAN SERVICES, E-WALLET / FINTECH APP SERVICES
- MOBILITY (E-BIKES)

EG

MNT-Halan restructures pool of vehicle financing receivables as bond for fixed-income investors

MNT-Halan, resulting from a 2018 leveraged buyout deal between a digital wallet provider and MNT Investments, a longstanding microlending platform from Egypt, offers a comprehensive digital ecosystem in Egypt. This ecosystem, powered by its proprietary technology, Neuron, seamlessly links consumers, merchants and micro-enterprises, offering a diverse range of services from light-vehicle finance, courier, delivery and ride-hailing services, to payments and e-commerce. With an expansive client base, MNT-Halan stands as Egypt’s sole private billion-dollar enterprise, serving over five million customers, of which 3.5 million utilise its financial services.

- DIGITAL PLATFORMS, AI AND ADVANCED DATA PROCESSING
- E-WALLET / FINTECH APP SERVICES, CREDIT, LENDING, & LOAN SERVICES, MASS PAYOUT/ COLLECTIONS SERVICES
- MOBILITY & ECOMMERCE SUPERAPP

KE

d.light announces record-breaking multi-currency receivables vehicle through Brighter Life Kenya (BLK) 1 & 2

BLK1 is a financial vehicle designed to offer local currency impact finance for d.light’s Kenyan PAYG SHS operations, aiding its growth by ensuring a consistent flow of working capital through receivables funding. This model is set to continue with BLK2, aiming to provide d.light with multi-currency financing up to \$238 million over two years, initially for its Kenyan venture with an expansion vision for other African countries. Partner Solar Frontier is gearing up with a projected \$100 million for receivables lending to SHS firms and established a \$65 million facility for d.light Kenya in 2020, inclusive of \$20 million from US DFC.

- DIGITAL PLATFORMS, SMART SENSORS AND IOT
- CROSS-BORDER TRANSACTIONS AND FX SERVICES
- ENERGY (STANDALONE PV)

KE

Sun King and Citi collaborate on multi-million local currency receivables transaction for PAYG solar

Sun King and Citi have collaborated on a pioneering \$130 million securitisation transaction, denominated entirely in Kenyan Shillings, aimed at leveraging payments from Sun King’s Kenyan customers for solar products to fund further growth. Through this structure, future customer payments for credit-purchased solar products are securitised, connecting over a million primarily unbanked or underbanked customers to necessary financing for solar purchases and offering investors risk-diversified returns in an underserved market.

- SMART SENSORS AND IOT
- ENERGY (STANDALONE PV)

KE

IMFact provides receivables financing to asset-heavy Kenyan enterprises

IMFact is an expanding fintech company pioneering a new, technology-driven approach to receivable financing to avail working capital to MSMEs, particularly for vehicle finance and logistics enterprises like Amitruck, a trucking logistics marketplace that allows transporters (owners of motorbikes, pick-ups, vans and trucks) to find and connect with customers through its mobile and web applications. As a ‘pooled receivables’ factoring business, IMFact purchases bulk invoices from such organisations for a mix of upfront cash and deferred payments, allowing for faster cash-conversion cycles. With FSDAi support, IMFact expects to purchase over \$600 million in receivables in Kenya and expand to five additional countries.

- DIGITAL PLATFORMS, ALT-DATA AND RISK ASSESSMENT
- CREDIT, LENDING & LOAN SERVICES
- MOBILITY (LOGISTICS/TRANSPORT)

IN

Credable completes India’s first securitisation of a pool of trade receivable loans

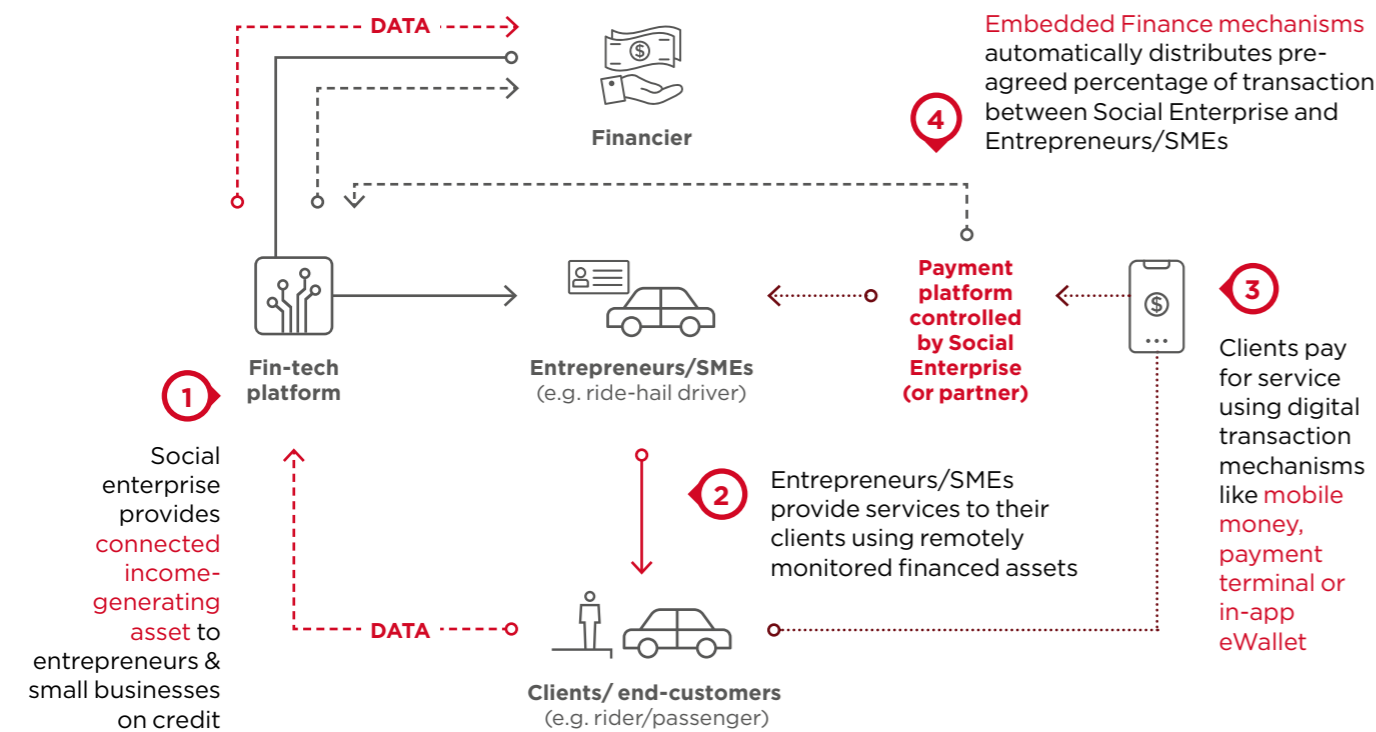
Credable is one of India’s leading fintechs. Founded in 2016, the Mumbai-based startup provides post-and pre-invoice financing. The fintech completed India’s first securitisation of receivable loans under the Reserve Bank of India’s evolving regulations concerning non-bank financial corporations with partner Northern Arc Capital. This unlocked millions of dollars in invoice-backed working capital for microfinance providers, SMEs, and vehicle financiers. Credable partners with IT solutions providers to help SMEs digitise invoices, enabling them to access receivables financing. Underwriting and credit analytics are enabled by Credable’s proprietary credit scoring, augmented by machine learning and AI. The company has raised nearly \$60 million to date.

- DIGITAL PLATFORMS, ALT-DATA AND RISK ASSESSMENT, AI
- MOBILITY (VEHICLE LOANS) AND MSME WORKING CAPITAL

Figure 6

Revenue sharing arrangement

Revenue-Sharing



3.3 Revenue share

Revenue sharing is a financial arrangement where stakeholders distribute operating profit or revenue based on their roles in a shared business initiative. The model is based on repayments as a flow of future revenues rather than fixed repayments, aligning incentives among borrower and lender and distributing the risk. A critical feature of these instruments is the design and mechanism by which the financier paid from the earnings. Properly implemented, revenue sharing can optimise profitability while maintaining equitable distribution among collaborators. In the context of varying degrees of traditional venture capital liquidity amidst the continuous need for startups to raise capital, revenue sharing has been growing and is an attractive alternative option, as these models do not require a company's founder to dilute equity, give up board seats, or put up any collateral. It also provides social enterprises exploring innovative business models in low-income settings with more runway to build a longer track record, establish product-market-fit, and prove their value in the market.⁶⁴ For investors, revenue share models provide opportunities for consistent return in the absence of exponential growth paths.

Revenue sharing offers significant potential for the utilities sector in Africa and Asia, especially when financing income-generating/productive use assets and equipment. Traditional forms of capital in emerging markets are usually aimed at asset-light and high-growth companies.⁶⁵ Many social enterprises operating in utility service delivery, however, have higher asset/equipment requirements. Revenue sharing addresses this, presenting an innovative financing solution in regions where there is a \$5.2 trillion funding gap for small and medium-sized businesses.⁶⁶ Revenue sharing models principally solve the need for loans in the \$5,000 to \$20,000 range for hard assets, which can be de-risked by the use of asset tracking, digital platforms and advanced analytics. Where digital platforms include fully integrated payment systems, third party brokers can act as a digital escrow, limiting risk for the lender.

64. Triple Pundit (2021). *Revenue-Based Financing Gives Social Enterprises Room to Grow and Deliver on Their Mission*

65. Untapped Global (2021). *The \$5.2 Trillion VC Blindspot*.

66. International Finance Corporation (2017). *MSME Finance Gap: Assessment of the Shortfalls and Opportunities in Financing Micro, Small, and Medium Enterprises in Emerging Markets*.

Little has been documented specifically about revenue sharing models in Africa and Asia to date. Revenue sharing models in these geographies are most commonly found among telecommunications splitting the costs of tower expansion,⁶⁷ or software developers sharing revenues on apps preloaded on devices.⁶⁸ This research also identified initiatives pioneering these instruments in mobility and productive-use equipment financing. Lenders like **Untapped Global** have developed smart asset financing offerings based on trackable assets such as **FlexClub's** subscription based e-bike platform,⁶⁹ while **Unconventional Capital** place the revenue sharing emphasis on the entrepreneurs themselves through digital psychometric tests. In India, the revenue-based financing ecosystem has grown rapidly with more and more funders specialising in the market, including **N+1 Capital**, **GetVantage**, **Klub**, and **Velocity**. The rise of e-commerce and the increased role of technology underpinning business' revenues, sales, marketing and operations is seen as a key catalyst for this growth as data and live monitoring becomes the 'new collateral'.⁷⁰ As of 2022, the revenue-based financing market opportunity in India is already estimated to be at \$5-8 billion and is estimated to grow to \$40-50 billion by 2025.⁷¹ GetVantage is a prime example of this growth potential, onboarding over 9,000 businesses on their data-driven lending platform in 2022 and helping over 450 SMEs access between 10 lakh rupees (~\$12,200) and 10 crore rupees (~\$1.2 million).⁷²

Revenue-based financing models face issues of market fragmentation and the complexity associated with managing portfolios of distributed assets. Revenue sharing models in emerging markets depend on establishing ability to repay without traditional forms of collateral. This implies the need to aggregate historical sales/customer acquisition data to make risk-sensitive lending decisions, which can be a challenge for early-stage companies that lack a track record or have not invested in digital platforms to manage their sales and customer relations.

The growth in embedded finance mechanisms constitute one of the most significant opportunities for scale for revenue-based instruments. These transaction mechanisms integrate financial services seamlessly into non-financial platforms or applications, enhancing user experiences by offering contextually relevant financial products without leaving the primary interface. In the cases identified in this research, this often takes the form of a payment interface linked to a digitally enabled asset that automates the deduction of a portion of transaction. Such a mechanism embedded into the software of a point-of-sale machine, for example, can seamlessly ensure its financier receives a portion of each transaction the machine processes.

Remaining challenges to scaling revenue sharing models revolve around structuring models that are appropriate to the idiosyncrasies of different utilities sectors and investor types. Emerging insights from the model reveal that certain sectors work better with revenue sharing models than others. The incentive structures and politics of water, for example, differ significantly from those of solar panels. Regulatory regimes, including tariffs, may be more tightly controlled in certain markets for water. Water issues are often more politically sensitive, inhibiting the participation of blended finance players. The electric mobility sector offers several promising examples but is not yet mature as a sector, requiring more data before the model can be scaled.

67. European Investment Bank (2021). *Unlocking digital connectivity in Africa*.

68. Bain & Company (2010). *Enabling growth: Horizontal opportunities for the ICT sector*.

69. Untapped Global (2023). *An Interview with Tinashe Ruzane: Powering The First Electric Motorcycle Subscription in Mexico*.

70. Fortune India (2021). *Pledging revenues: start-ups' new funding model*.

71. Tech Crunch (2022). *GetVantage offers revenue-based financing to India's founders*.

72. Rest of World (2023). *As traditional VC funding slows, revenue-based financing is becoming popular*.

Spotlight 8 Untapped Global addresses SME financing gap

Untapped Global offers profitable, data-driven investment opportunities to global investors to finance high-growth businesses. Untapped developed an investment platform and capital facility for Smart Asset Financing, which lends to businesses through connected assets, using real-time data and digital payments to ensure repayment. The model tracks an asset's usage and how much revenue it generates in real-time using IoT technology and pays investors healthy returns through its revenue share model. This alternative approach to managing risk provides a more transparent, safer approach to financing of revenue-generating assets for entrepreneurs and SMEs in emerging markets.⁷³ The Untapped model intends to provide transparency for international investors looking to tap into emerging markets. The company has now used this model to finance more than 5,000 entrepreneurs working across the energy, water, e-mobility and fintech sector.

The role of digital

The capability of asset tracking through IoT, paired with platform analytics applied to the associated data, are key to revenue sharing models. Critical for revenue-based financiers is line of sight into source data to ensure deals are being honoured according to the agreed revenue share arrangement. This can be tied to the usage of a particular asset where remote monitoring of assets is feasible. Just as important is visibility into cash revenues, which can be automated through integrations with payment processing systems, accounting software and mobile money integrations. Aggregating these data across borrowers is essential to developing a portfolio view of lending activities, which can generate the credit scores needed to drive scale.

Revenue sharing also taps the opportunities of app-based ecosystems. Digital platforms that connect buyers and sellers of higher-value goods and services are particularly good fits for revenue sharing models leveraging embedded financing.⁷⁴ For example, vehicle financiers like Moove and BasiGo partner with such platforms to ensure collections are automated and streamlined. Where

digital financial services are available, revenue sharing models can also entice entrepreneurs into trying new financial products. Kopo Kopo, for example, use data from customers' digital business accounts, and automatically subtracts repayments from daily sales revenue.

Key opportunities

- **The expansion of real-time performance analytics capabilities supports revenue share models' growth.** Manually aggregating business analytics is a significant pain point for founders. The ability to monitor portfolio health in real-time supports revenue share model adoption.
- **The increasing aggregation of data analytics through APIs and decreasing costs of remote monitoring may also drive the scale of such instruments.** The ability to collect increasing amounts of data from different devices and payment streams that easily integrate into monitoring platforms will likely lead to an increase in lenders and implementers leveraging this model. Existing players anticipate that as the model is replicated, there will be a role for project aggregators using cross-sectoral data to unlock further investment opportunities.
- **The combination of advanced analytics, IoT, and blockchain-based smart contracts supports the expansion of revenue sharing to further asset classes.** Blockchain-based contracts can help support the viability of longer-term lending arrangements like those in the education sector. Examples of income-sharing models of this type, where repayment of student loans are tied to a percentage of income upon graduation, have been pioneered by organisations like Chancen International and African Leadership University.
- **Cross-border blockchain solutions could additionally support geographic expansion of revenue sharing instruments.** If the model takes off across geographies, it will be necessary to reconcile revenue streams across a multitude of different currencies. It may become attractive for investors to hold a token representing the future value of a dollar's worth of assets representing a 'millionth of a motorcycle'. Smart contracts could automatically manage forex exchanges to create a seamless and automated investment experience for investors interested in cross-country exposure.

73. TechCrunch (2022). *How Untapped Global plans to bring the revenue financing model to African startups.*

74. Mattern, M. (2020). *Innovations in Asset Finance: Unlocking the potential for low-income customers.* CGAP.





KE

Unconventional Capital uses automated data-driven processes for revenue share lending to entrepreneurs in SSA

Uncap introduces an innovative, remote and automated method of funding early-stage entrepreneurs by assessing their potential through tests gauging skills linked to entrepreneurial triumphs. Operating under a revenue-based financing model, Uncap typically acquires a minority stake (around 10%) in businesses, allowing entrepreneurs to repurchase their equity based on company growth; generally about five to seven% of monthly revenues. So far, Uncap has invested in 77 businesses across seven Sub-Saharan African countries, spanning diverse sectors. The venture predominantly targets registered businesses in countries like Kenya, Uganda and Nigeria with a track record of over €10,000 yearly revenues, operational history between 12-48 months, and scalability potential.

- ALT-DATA AND RISK ASSESSMENT
- CREDIT, LENDING, & LOAN SERVICES
- AGRICULTURE

KE

Kopo Kopo enables short term loans to off-grid energy

Kopo Kopo, a Kenyan business payment processor, offers ‘Grow’ loans—unsecured cash advances up to \$50,000—by evaluating customer sales data for loan eligibility. The firm assesses eligibility swiftly using historical data from its platform; upon approval, funds are instantly transferred to the borrower’s Kopo Kopo account. Repayments are conveniently subtracted from the borrower’s daily sales, and these loans serve as supplementary credit options, with various off-grid solar (OGS) distributors in Kenya already benefiting from Kopo Kopo Grow loans.

- ALT-DATA AND RISK ASSESSMENT
- CREDIT, LENDING, & LOAN SERVICES
- EMBEDDED FINANCE SERVICES
- STANDALONE PV

NG

Moove’s vehicle financing solution for ride-hailing

Moove offers a flexible solution for aspiring ride-hailing drivers, enabling them to obtain cars without resorting to traditional loans or borrowing. Once drivers register and are verified on Moove, they undergo training and then sign contracts to secure loans for purchasing or renting vehicles. Partnering exclusively with Uber in Africa, Moove deducts the weekly rental fees from the drivers’ earnings and transfers the remainder to them. The loans, which span 12 to 48 months and carry an annual interest rate of eight% to 13%, allow drivers to own the cars upon full repayment.

- DIGITAL PLATFORMS, ALT-DATA AND RISK ASSESSMENT, SATELLITE EARTH OBSERVATION, GIS AND GEOSPATIAL
- CREDIT, LENDING, & LOAN SERVICES, EMBEDDED FINANCE SERVICES
- MOBILITY

NG KE UG TZ

Credable provides B2B2C loans on a revenue share basis

Credable enables mobile operators, e-commerce platforms and logistics companies to embed and enable banking products for their customers within their existing platforms. They started in the lending space with a 30-day term loan product in partnership with Vodacom M-Pesa in Tanzania and a short-term lending product for Diamond Trust Bank in Kenya. Since then, Credable has enabled over six products for various businesses, from banks and MNOs to e-commerce platforms and fintech players across three markets: Tanzania, Kenya and Uganda. So far, over 1.2 million people have opened accounts on its platform and more than 200,000 customers (including consumers and SMEs) have used its banking products. These include savings products, term loans, overdrafts, asset financing and other credit solutions. Credable’s platform has helped disburse \$5 million worth of loans and seen over \$3 million deposits into its savings products. The two-year-old fintech employs a revenue sharing model with all its partners.

- DIGITAL PLATFORMS, ALT-DATA AND RISK ASSESSMENT
- EMBEDDED FINANCE SERVICES, CREDIT, LENDING, & LOAN SERVICES
- ECOMMERCE AND AGRITECH

IN

GetVantage’s revenue-based lending model

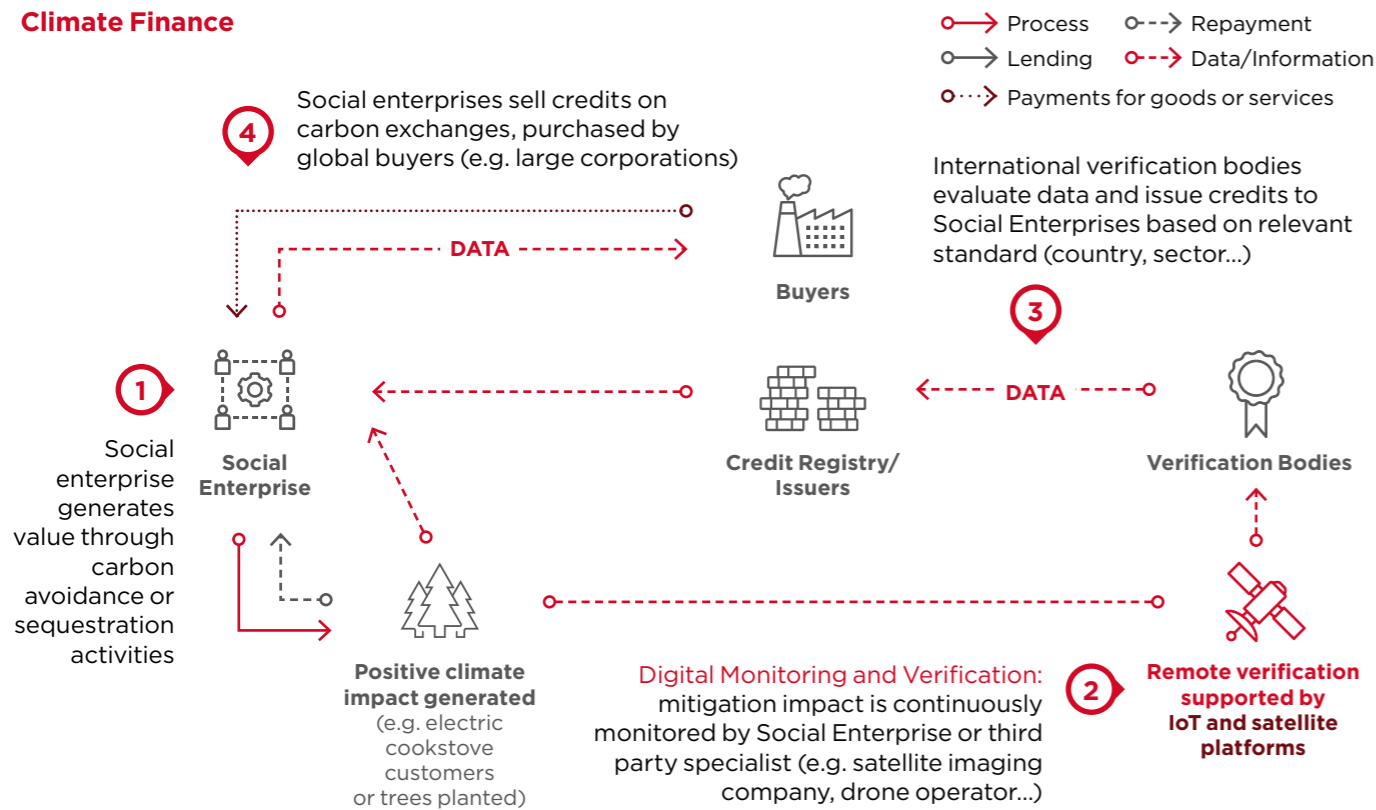
GetVantage gives SMEs equity-free capital between \$10,000 and \$500,000, with applications processed in about two days, and funds made available in five. It says that about 4,000 businesses have applied for non-dilutive financing through its platform so far, receiving a total of \$270 million in funding. The company has invested across sectors such as e-commerce (majorly D2C), SaaS, cleantech and electric vehicle ecosystem. Its clients include Arata, BoldCare, Charge Zone, Eat Better, Jade Forest, Naagin, Nua Wellness, Rage Coffee, Sid Farms and Zymrat. Financing decisions are made using the company’s proprietary machine-based learning model called the Credit Decision Engine and cloud-based Deal Management System. Companies typically repay financing in about six to nine months, with repayments completely linked to revenue based on pre-agreed flat fees between 6-12%.⁷⁵

- DIGITAL PLATFORMS
- EMBEDDED FINANCE SERVICES
- E-MOBILITY AND CLEAN TECH

75. Tech Crunch (2022). *GetVantage offers revenue-based financing to India’s founders.*

Figure 7

Financing through voluntary carbon markets



3.4 Climate finance

Climate finance is a broad term encompassing financial resources mobilised for the specific purpose of achieving social and environmental adaptation and mitigation targets. Almost a fifth of global emissions are now covered by carbon ‘compliance markets,’ — the combined size of the 30 emissions trading systems operating globally. Within these schemes, carbon intensive industries must, by law, account for their greenhouse gas emissions and pay either through taxation or credit exchange-based markets. In 2021, the combined value of these compliance markets was \$850 billion.⁷⁶

Separate to the compliance market are the voluntary carbon markets (VCMs), where credits (different to those in the compliance market) are generated and bought by companies or individuals to offset carbon impacts. The VCM market is largely unregulated but operates through norms and standards developed within the market. At present, theoretically, anyone could issue a ‘credit’ to be bought, but in reality, the vast majority are mediated by independent agencies like Verra, the Gold Standard, and the American Carbon Registry, among others. Globally, VCMs grew at a compound annual rate of over 30% from 2016 to 2021, based on carbon credit retirements, reaching a market valuation approaching \$2 billion today and expected to grow to \$50 billion by 2030.⁷⁷

Climate finance in the utilities sector in Africa and Asia has focused on the renewable energy space and nature-based solutions. Since 2020, Verra and Gold Standard only issue credits for renewable energy projects in emerging markets, as those in developed markets have ‘matured-out.’⁷⁸ While the majority of such projects remain at the large facility or grid-connected level, smaller, distributed systems like solar systems may benefit from climate finance as project aggregation combines different providers’ portfolios.⁷⁹ For example, the Clean Cooking Alliance report that carbon credit sales in VCMs now account for nearly a third of the revenues of their members,⁸⁰ with e-mobility particularly well-positioned to benefit. The **Container-Based Sanitation Alliance**, furthermore, is in the process of exploring the potential in the sanitation sector.⁸¹

Accurate methodologies for certifying environmental impact remain a significant obstacle for climate finance. Recurring controversies around the multiple counting of climate projects’ environmental impact threaten to undermine trust and credibility that credits purchased or traded represent real environmental value. Recent research in the cooking sector, for instance, highlights an over-counting of emissions reductions from fuel switching on the order of 6.3 times.⁸² Questions surrounding the veracity of certain types of credits (particularly forestry-related ones) have caused major global brands to either drop or reassess net-zero claims made based on those credits.

Many small project developers also face significant barriers to entry for producing credits, and when they are produced, intermediaries can capture much of the value. Registering, verifying and selling credits can be both time consuming and expensive, and high upfront costs lock many smaller project developers out of the market. Project development can take between 1.5 and six years, and investors and intermediaries on average capture one third of the market value.⁸⁵ Trading is big business; for example Xpansiv—the largest global exchange platform for energy and environmental commodity products, and a carbon broker used by many global brands—reached a market capitalisation of \$2 billion in 2022.

Spotlight 9 ATEC sells carbon credits based on verified usage of IoT-enabled eCookstoves

ATEC Global is a social enterprise across Asia that exists to solve clean cooking and climate change through patented IoT stoves that connect emerging market households with the international capital opportunities of PAYG and carbon credits. ATEC was the first company to develop PAYG integration into the cookstove sector in 2018, about the same time they started looking at climate financing. Seeing the opportunity, they invested in embedding IoT capabilities through tech provider Aeris. Five years later, they are now the first in the sector to have built a full hardware dMRV and data backend that is Gold Standard certified. In the future, they expect the conversion of IoT data into certified carbon credits to be entirely automated through API connections linking device data to certifying bodies’ platforms. Given recent verification controversies in the voluntary carbon markets⁸³ and in the cooking sector specifically,⁸⁴ ATEC believes there will be a mass transition to dMRV for climate finance.

76. BNEF (2022). *The Untapped Power of Carbon Markets in Five Charts*.

77. Blaufelder, C. et al. (2021). *A blueprint for scaling voluntary carbon markets to meet the climate challenge*. McKinsey.

78. IEA (2023). *Electricity Market Report 2023*.

79. UNDP (2022). *Linking Global Finance to Small-Scale Clean Energy*.

80. Clean Cooking Alliance (2022). *2022 Clean Cooking Industry Snapshot*

81. Andriessen, N. et al. (2023). *Quantifying Greenhouse Gas Savings from Container-based Sanitation* in Sandec News No. 23 09/22

82. Wiehl, A. et al. (2023). *Cooking the books: Pervasive over-crediting from cookstoves offset methodologies (preprint)*. University of California, Berkeley.

83. The Guardian (2023). *Revealed: more than 90% of rainforest carbon offsets by biggest certifier are worthless, analysis shows*.

84. Wiehl, A. et al. (2023). *Cooking the books: Pervasive over-crediting from cookstoves offset methodologies (preprint)*. University of California, Berkeley.

85. Thallo (2022). *Fast Forward: Challenges to Scaling the Voluntary Carbon Market*

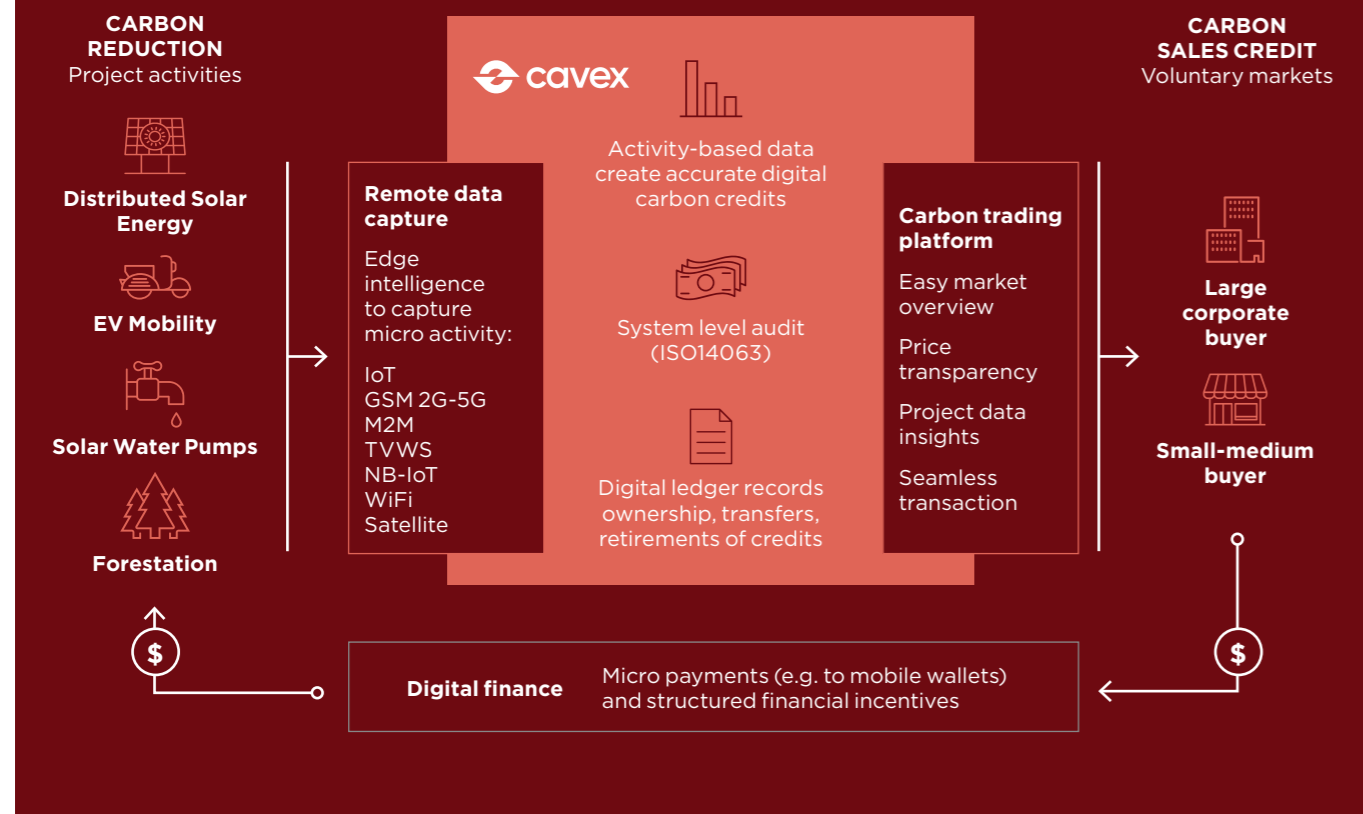
The role of digital

Digital technologies are a critical enabler for the generation, certification and exchange of climate finance. In a [previous report](#), the GSMA highlighted the role of digital technologies in enabling different public and private climate finance mechanisms. As the report showcases, some digital technologies are already playing an important role in climate finance, while other emerging technological use cases are being tested to help overcome some of the

barriers associated with accessing climate finance in LMICs. The principal group of technologies that support climate finance are satellite-based earth observation methods for the verification of nature-based solutions like afforestation or conservation, blockchain for addressing the double-counting challenges of carbon issuance, IoT and sensors for data acquisition, and to a lesser extent, drones and AI.⁸⁶ Digital platforms act as connecting tissue across these technologies as well as stakeholders; [Mirova SunFunder](#) is exploring the development of such a

Spotlight 10 4RD builds the carbon value exchange digital platform leveraging IoT data

The Carbon Value Exchange Platform (CaVEx) by 4R Digital is a cloud-based marketplace that streamlines the collection, verification, and monitoring of data on small climate-positive projects and enables transparent trading. Utilising IoT and M2M connectivity, it remotely monitors activity levels to assess carbon impact, centralising the verification process and significantly reducing the costs of issuing quality carbon credits. The platform also directly facilitates micropayments from carbon credit sales to those involved in the projects, enhancing capital flow to local initiatives combating climate change and supporting livelihoods in LMICs.



digital platform to aggregate the carbon rights of distributed renewable energy companies through a special purpose vehicle.⁸⁷ A range of other digital platforms supported by prominent investors and foundations are aiming to reduce entry barriers for early-stage companies in LMICs in the voluntary carbon market, and aggregate projects to make them more attractive to major investors and corporates:

- [Cynk](#), a verifiable emissions reduction platform operating across Africa, aims to use a public decentralised ledger to track emission reductions. It has already enabled a carbon futures transaction of more than two million credits for Tamuwa, Kenya's leading renewable biomass fuels producer,⁸⁸ and aims to operate across other use cases including nature-based solutions, blue carbon, regenerative agriculture, direct carbon capture, and renewable energy.
- The Carbon Value Exchange Platform (CaVEx) by [4R Digital](#) is a cloud-based marketplace that streamlines the collection, verification and monitoring of data on small climate-positive projects and enables transparent trading. In collaboration with UNDP, CaVEx is currently exploring opportunities to leverage its platform to bundle debt and results-based payments with climate finance.⁸⁹
- [Verst Carbon](#) is an integrated carbon markets technology enabler buckling down on alleviating bottlenecks that hamper Africa's carbon markets. Their solution has four key pillars, including innovative financing for carbon project development, incorporating digital MRV to counter verification and validation capacity constraints, community revenue repatriation and governance, and disintermediation of carbon market value chains through the provision of direct market place access.⁹⁰

Geospatial/satellite technologies form the backbone of digital monitoring, reporting and verification (dMRV). Satellites enable the tracking and assessment of emission sources and carbon sinks such as forests and oceans. They offer a transparent and consistent way to monitor changes over time, whether it is in deforestation rates or urban emissions. The data obtained from satellite imagery greatly enhances the reliability of carbon offset projects, ensuring credits are based on verifiable emission reductions or removals.

Blockchain technologies find some of their strongest real-world applications in supporting the auditability of climate finance. By creating a decentralised and immutable ledger of transactions, blockchain ensures carbon credits transactions can be accurately recorded. This prevents double counting and fraud, enhancing trust in the carbon market. Moreover, smart contracts within the blockchain can automate various parts of the transaction process, making the entire system more streamlined.

Remote monitoring technologies have proven particularly critical to the intersection between climate finance and renewable energy. Information from smart-sensors reporting on performance of renewable energy projects are critical to the quantification of their displacement of emissions. International Renewable Energy Credits (I-RECs), for example, are a market-based instrument that certifies the holder owns a megawatt-hour (MWh) of electricity from a clean energy source outside of developed markets; these rely on regular technical data to verify ongoing performance of assets over their lifetime.

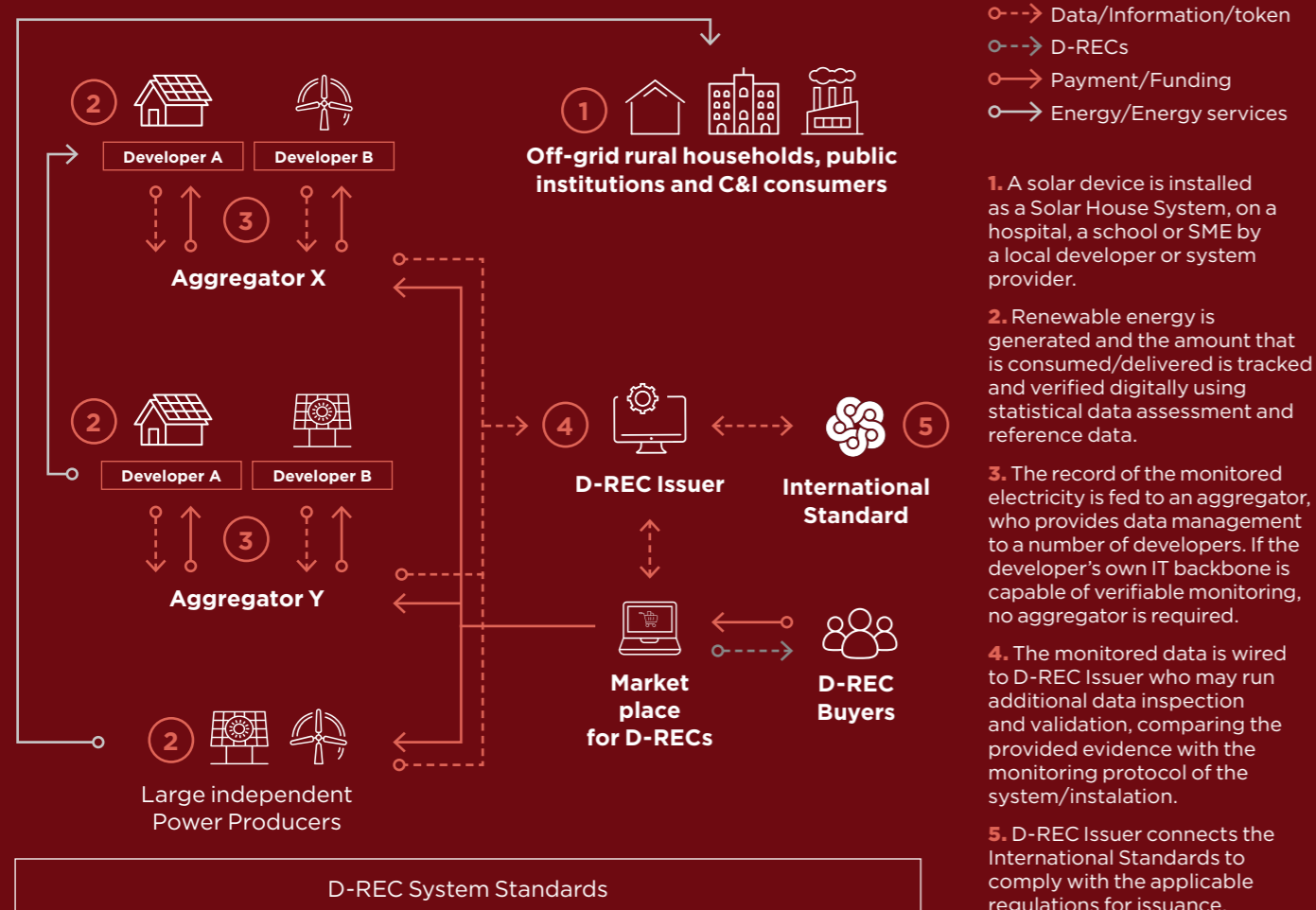
86. World Bank (2022). [Digital Monitoring, Reporting, and Verification Systems and Their Application in Future Carbon Markets](#).
87. UNDP Climate Aggregation Platform (2023). [Carbon Credit Aggregator Platform: Financial aggregation solution by Mirova SunFunder](#)

88. Bloomberg (2023). [First African Offsets Platform Begins With Record 2 Million Credit Trade](#).
89. UNDP (2023). [UNDP to support seven innovative financial solutions for clean energy in East Africa](#).
90. Climate Tech Review (2023). [Verst Carbon: Innovating Africa's Carbon Markets for Climate Mitigation](#).

Spotlight 11 South Pole generates D-RECs based on blockchain and IoT monitoring

Distributed Renewable Energy Credits (D-RECs) are a form of International Renewable Energy Credit (I-REC) that use blockchain and remote monitoring to generate certified carbon credits. These are sold commercially as a 'premium' credit, which can be more than 10 times the price of a non-certified MWh. D-RECs are a high-impact mechanism to connect off-grid renewable energy entrepreneurs to new investment opportunities. Salesforce has recently committed to a forward contract worth \$65 million in carbon credits through D-RECs.

Process of generating D-REC



The D-REC Initiative was launched in January 2021 by South Pole, together with Positive.Capital Partners, with support from The Shell Foundation, EnAccess Foundation, Good Energies Foundation, Signify Foundation, GIZ-DeveloPPP, the UK's Foreign, Commonwealth and Development Office (FCDO), UNDP, the IFC, and the Swiss Agency for Development and Cooperation (SDC).⁹¹

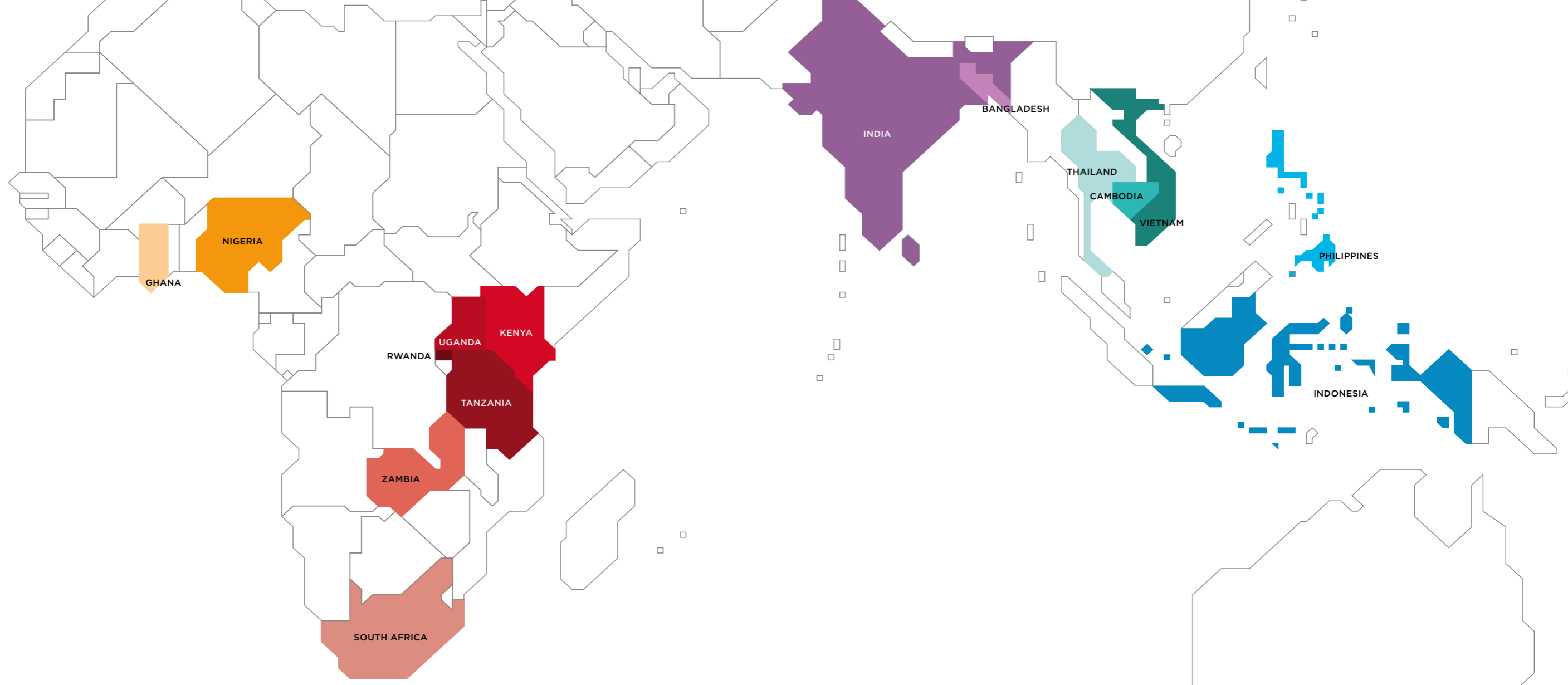
Key opportunities

- **The digital tracking of hardware devices to generate credits is a clear trend that will speed up the accessibility of climate finance for utility service providers.** While the upfront costs associated with dMRV via IoT can be prohibitive, given the necessity for integration into firmware and hardware design from inception, leading experts in climate finance for sectors such as eCooking anticipate these investments will yield significant returns. This expectation is bolstered by predictions of stabilisation in voluntary carbon market prices at attractive levels, coupled with demand for robust verification from buyers.⁹²
- **Blockchain technology is poised to play a crucial role in the scale-up of climate finance volume.** Initiatives leveraging blockchain, such as Distributed Renewable Energy Certificates (D-RECs), are building market confidence through enhanced traceability. There is a trend toward standardisation and accessibility in these technologies, with modular software-as-a-service (SaaS) solutions lowering development costs for digital ledger services. This shift mirrors the widespread corporate adoption of cloud computing services, akin to established platforms like Microsoft Azure and Amazon Web Services.
- **The burgeoning growth of digital identity mechanisms may become a vital component in the evolution of co-benefits monetisation within the climate finance landscape.** The growing ubiquity of smartphones offers a step-change in the automated verification of identity through voice, face, thumbprint, or iris-activated recognition. Combined with digital payments, these identities enable the benefits of carbon credit sales to flow directly to end users. Examples like A2EI's Impact Survey Bot, mass user-sourced data collection company Premise, and phone-based verification systems like those employed by 60 Decibels are positioned to capitalise on the analytical capacities spawned by chat-based AI technologies.
- **The consolidation of cross-border payment providers is pivotal for channelling climate funds to small-scale projects globally.** A key challenge is distributing funds across diverse payment methods, complicated by interoperability issues among mobile wallets. Market reports suggest imminent consolidation in African and Asian payment corridors through mass-payout aggregators like MFS Africa and PAPPS. Blockchain, especially smart contract platforms like Ethereum, could play a pivotal role here in automating flows of climate finance across borders in this way.
- **Evolutions in market from the COP climate negotiations provide possible opportunities for project developers.** Article 6.2 of the Paris Accord envisaged the creation of new internationally tradable credits - internationally transferred mitigation outcomes (ITMOs) - that can be counted towards governments national targets. There is enough of the global architecture in place for countries to begin transacting ITMOs under bilateral agreements. In one of the very first cases, ITMOs were exchanged for private entities to fulfil obligations under the Swiss CO2 Act under a bilateral agreement with Peru. Article 6.4 of the Paris Accord also aims to create a global market for carbon trading that will be supervised by a UN body. Credits created in this market will be known as 'A6.4ERs' (Article 6.4 Emissions Reductions). While the shape of the market for A6.4ERs is still subject to negotiation, as noted in a recent World Bank report, "the implications of evolving guidance under Article 6 for voluntary carbon credit demand are still unclear, but the requirements of different buyers could converge".⁹³
- **Social impact co-benefits monetisation is crystallising as a future growth area within the scope of climate finance.** As with carbon credits that are bundled with certified nature or biodiversity benefits, community benefits—such as renewable energy generation, peacebuilding initiatives and gender equality—can be traded at a premium relative to standalone carbon credits. Initiatives developing methodologies for calculating indicators of social value are needed to strengthen such co-benefits monetisation, like those pioneered by the W+ Standard. This partnership between Verra and WOCAN allows climate finance projects to gain an additional certification tied to quantifiable contributions to women's empowerment.⁹⁴

92. The Guardian (2023). Delta Air Lines faces lawsuit over \$1bn carbon neutrality claim.

93. World Bank (2023). State and Trends of Carbon Pricing 2023.

94. WOCAN (2021). How the scaling of voluntary carbon markets can amplify gender equality impacts.



KE UG

SunCulture increases affordability of solar water pumps through climate finance

SunCulture Kenya began selling its first carbon credits in 2022, using carbon revenue to reduce the cost of the adoption of its solar irrigation systems to a price below existing diesel and petrol water pumps.

- SMART SENSORS AND IOT
- PAYG SERVICES
- PRODUCTIVE USES OF ELECTRICITY (SOLAR WATER PUMP)

NG ZM KE

Acorn leverages satellite imagery to verify agroforestry credits

Acorn currently supports over 25,000 farmers across 10 countries in Latin America, Africa and Asia and aims to onboard 10 million farmers onto its platform by 2030. Satellites are used to measure biomass growth by smallholder farmers, selling on voluntary carbon markets through Plan Vivo certification. 80% of the value of the credits are returned to farmers through a combination of cash (verified manually), mobile money, and bank transfers. Mass-payout options are anticipated to drastically lower the cost for last-mile disbursement across geographies.

- SATELLITE EARTH OBSERVATION, GIS AND GEOSPATIAL
- FARMERS (AGROFORESTRY)

KE IN

Sistema.bio taps into carbon finance in lowering cost of biodigesters for farmers

Sistema.bio is a biodigester company that taps into climate finance in partnership with South Pole to lower costs for its users. It relies on TaroWorks, an app-based CRM technology that enables it to collect alternative indicators in addition to standard metrics such as client revenue and costs to predict repayment behaviour; these include animal health, farm cleanliness, and customer costs. The app integrates with mobile billing to track repayments and inform credit scoring.

- DIGITAL PLATFORM
- MOBILE MONEY INTEGRATIONS
- ENERGY (BIODIGESTER FOR TURNING AGRICULTURAL BYPRODUCT INTO COOKING FUEL)

KH BD RW

ATEC generates certified carbon credits from usage of IoT eCookers

ATEC's eCook stove uploads data on cooking usage to a central dashboard that can be verified by a third party and converted into Gold Standard certified carbon credits. With 12,000 IoT-connected devices sold, ATEC will be issuing its first dMRV credits in 2023. Multinational utility company ENGIE has committed to purchasing 11.5 million tonnes of carbon credits from ATEC through this process.

- SMART SENSORS AND IOT
- PAYG SERVICES
- ENERGY (ELECTRIC COOKING)

GH ZA KE UG TZ BD TH VN PH ID

Lendable's blended finance solution makes climate-friendly loans and tracks impact through its interoperable platform

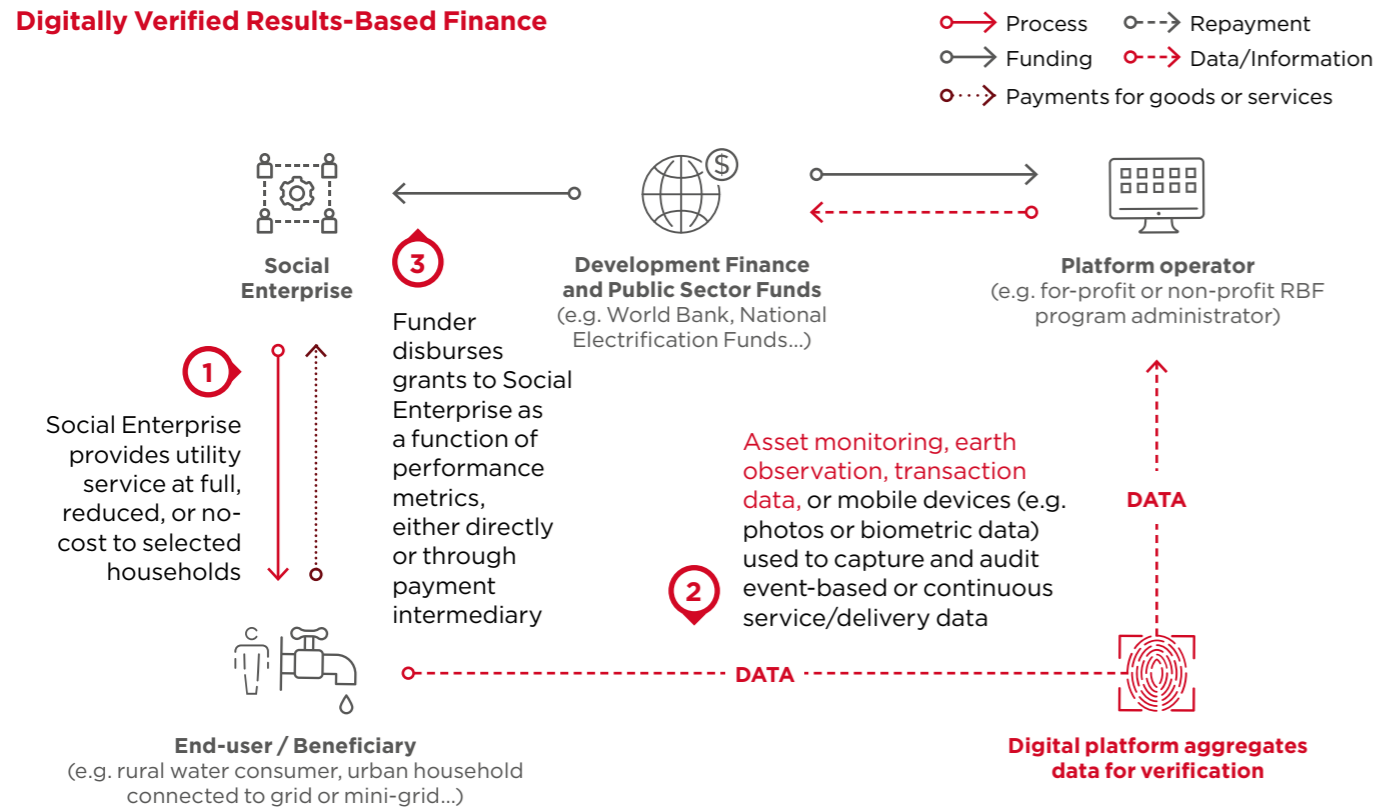
The Lendable Emerging Market Sustainability-Linked Loan Fund is a structured product that will provide sustainability-linked loans (SLLs) to SMEs in emerging markets to implement or scale a carbon mitigation, sequestration or adaptation solution as part of their business. Loans will generate quantifiable carbon benefits monitored via API by Lendable's Maestro system.

- DIGITAL PLATFORMS
- ALT-DATA AND RISK ASSESSMENT
- PAYG SERVICES
- (SOLAR WATER PUMP)

Figure 8

A digitally verified results-based financing initiative

Digitally Verified Results-Based Finance



3.5 Digitally-verified results-based finance

RBF mechanisms have become an increasingly popular tool for driving specific deliverable outcomes in development financing. In an RBF scheme, funders make payments to an agent who assumes responsibility for achieving pre-defined results. Funding is then released upon the independent verification of achievement of these results by a third party. Such approaches shift the financial risk associated with the non-delivery of results from the donor to the recipient.

Most RBF initiatives to date have targeted the health and education sectors in Sub-Saharan Africa. More recent examples of RBF models have targeted the utilities sector. The World Bank's Global Partnership for Results-Based Approaches (GPRBA) maintains a database of 227 studies on RBFs by sector, addressing key gaps in the availability of rigorous evidence for where and how RBF works in practice, particularly across sectors and geographies.^{95,96,97}

Published estimates broadly indicate that RBF schemes have grown from the low millions in the early 2000s to at least \$25 billion in the last decade.⁹⁸ Accurate figures for volumes of RBF flows suffer from definitional ambiguity around which instruments are counted in the category's broadest definitions.⁹⁹ These include variations on when flows are disbursed and what kind of triggers initiate payments.

95. Paul, E. et al. (2019). *We shouldn't count chickens before they hatch: results-based financing and the challenges of cost-effectiveness analysis*. Critical Public Health.

96. The GPRBA maintains a database of 227 studies on RBFs by sector, available at <https://www.gprba.org/knowledge/rbf-bibliography>

97. Howard, G. & White, Z. (2020). *Does payment by results work? Lessons from a multi-country WASH programme*. Journal of Water, Sanitation & Hygiene for Development.

98. GPRBA (2018). *A Guide for Effective Results-Based Financing Strategies*.

99. Vivid Economics (2013). *Results-Based Financing in the Energy Sector: An Analytical Guide*. World Bank.

One universally acknowledged obstacle to scaling RBFs is the upfront time and complexity required for linking verification to disbursement.

Traditionally, RBF approaches have required manual verification processes like site visits or phone calls, typically performed by contracted third-party verification agents. The complexity of verifying performance in practice can often outweigh the financial benefits for prospective RBF recipients; the average time from announcement to deployment in the mini-grid sector is over three years, for example.¹⁰⁰ Digitally verified RBF represents a significant opportunity to increase the accessibility of funding in the utilities sector. Automating elements of verification—the 'Achilles heel' of RBFs—can radically reduce the time and costs for smaller social enterprises without the resources needed to access traditional funding schemes.¹⁰¹ These have been particularly enabled by the combination of IoT technologies and digital payments, with notable examples from the energy and water sectors.¹⁰²

Performance standards, often custom-designed for specific programmes or sectors, hinder replicability and scalability. While innovations in remote monitoring and KYC processes have provided vast amounts of data, the lack of consensus on data verification units inhibits access to essential finance. Moreover, the absence of standardised digital verification tools burdens implementers, private sectors and programme administrators, causing hurdles in establishing fair validation processes for disbursement triggers. Data protection concerns and competitive dynamics further reduce the inclination of private sectors to share data. Another significant obstacle is the cost of connectivity. Remote areas low-income settlements still lack consistent connectivity, which is crucial for digital verification mechanisms. The lack of long-term funding clarity associated with RBF programmes is also a common concern.

The role of digital

Automated verification processes enabled by IoT are key value drivers scaling RBFs. Remote monitoring systems, such as smart-sensors and IoT, can capture detailed technical information about service delivery needed for observing/verifying results, such as the amount of time renewable or clean cooking assets are used to volumes of water dispensed. This automatic collection eliminates much of the need for in-person verification, reducing verification time and cost. Leading off-grid solar provider **Sun King**, for example, was able to reduce the lag between a sale and the associated RBF payments from three to four months to two to three months after the Nigerian Rural Electrification Agency introduced remote verification functionality into their disbursement process through the **Odyssey** platform in 2021.¹⁰³

Platforms that blend digital and manual processes complement one another in validating results. Some digitally-verified RBF programmes, like the **Uptime Catalyst Facility** subsidising rural water providers' operational costs based on performance, struggle to find grantees with modern data collection processes. To accommodate this, service providers can provide updates through standard spreadsheets, which are then digitally cross-checked against historical data for auditing purposes. **EnDev's** biogas RBF in Vietnam developed an app that independent quality controllers could use to upload information about the quality of the digesters, triggering incentives.¹⁰⁴

By harnessing libraries of APIs, digital platforms can seamlessly connect to cloud-based data warehouses, automated data visualisation tools, and verification functionalities. This not only ensures data integrity and facilitates manual checks, but also offers stakeholders fresh insights by exploring data in innovative ways. Additionally, the rise of PAYG systems has digitised payment processes, allowing for their integration into verification systems. Electronic payment providers further optimise this by enabling mass disbursements, making use of fintech partners within digital platforms' verification mechanisms.

100. AMDA (2019). *Smart RBF for achieving radical scale-up of Minigrads in Africa*.

101. CCA (2022). *Clean Cooking RBFs Key Design Principles*.

102. GSMA (2023). *IoT and Digital Payments: A game changer for results-based financing?*

103. See: <https://odysseyenergysolutions.com/news-insights/results-based-financing-at-scale-how-odysseys-remote-verification-feature-speeds-up-payments-for-renewable-energy-companies> (Accessed 15 September 2023)

104. EnDev (2021). *Transforming energy access markets with Results-based Financing*.

Key opportunities

- **The growing availability of software libraries facilitating the integration between sensors and platforms can support the speed of access for RBF.** In the energy space, for example, major inverter manufacturers SMA, BYD, and Victron are increasingly making remote monitoring a low-cost add-on to hardware sales, along with progressively simple data integration functionalities through APIs. As AI applications mature, the cost and effort to develop custom-made software that can support the integration between various kinds of IoT packages and data processing platforms is likely to decrease radically.
- **Decreasing hardware costs for specific remote monitoring applications can trigger a significant scale-up of RBF as monitoring matures into standalone business models.** Dedicated monitoring systems will continue to evolve in cost and sophistication with the increase in IoT for specific utility verticals, led by the continued growth of smart-meter companies for electricity billing like **SparkMeter** and **SteamaCo**. Water sensor hardware is also emerging from its infancy into more mature models, with the costs and usability of both rural handpumps and urban billing water systems set to decrease as companies like **CityTaps**, **Virridy**, and **charity: water** scale and refine operations, product offerings and services.
- **Significant commitments from development financiers and implementing partners have been announced that will continue to push digitally-verified RBF across sectors.** Such initiatives, like the UN's **Universal Energy Facility** or CEI Africa's focus on scaling mini-grids,¹⁰⁵ also have strong synergies with climate and nature-based finance with similarly strong digital monitoring and verification requirements. Early demonstrations of the advantages of digital verification of RBF can highlight opportunities in other sectors where digital platforms and IoT can help monitor usage and performance triggers.
- **The diverse and expanding array of communication technologies will drive further viability of digital RBF to more remote geographies.** Companies like **Starlink**, **Dots for Inc.**, **Pamoja Net** or **Ukama** that complement traditional mobile operators' coverage, as well as increasing availability of multi-network eSIM packages through Mobile Virtual Network Operators (MVNOs) like **Particle** and **Aeris**, can support traditional connectivity options that facilitate digital verification through remote monitoring as well as through traditional mobile-based verification methods.

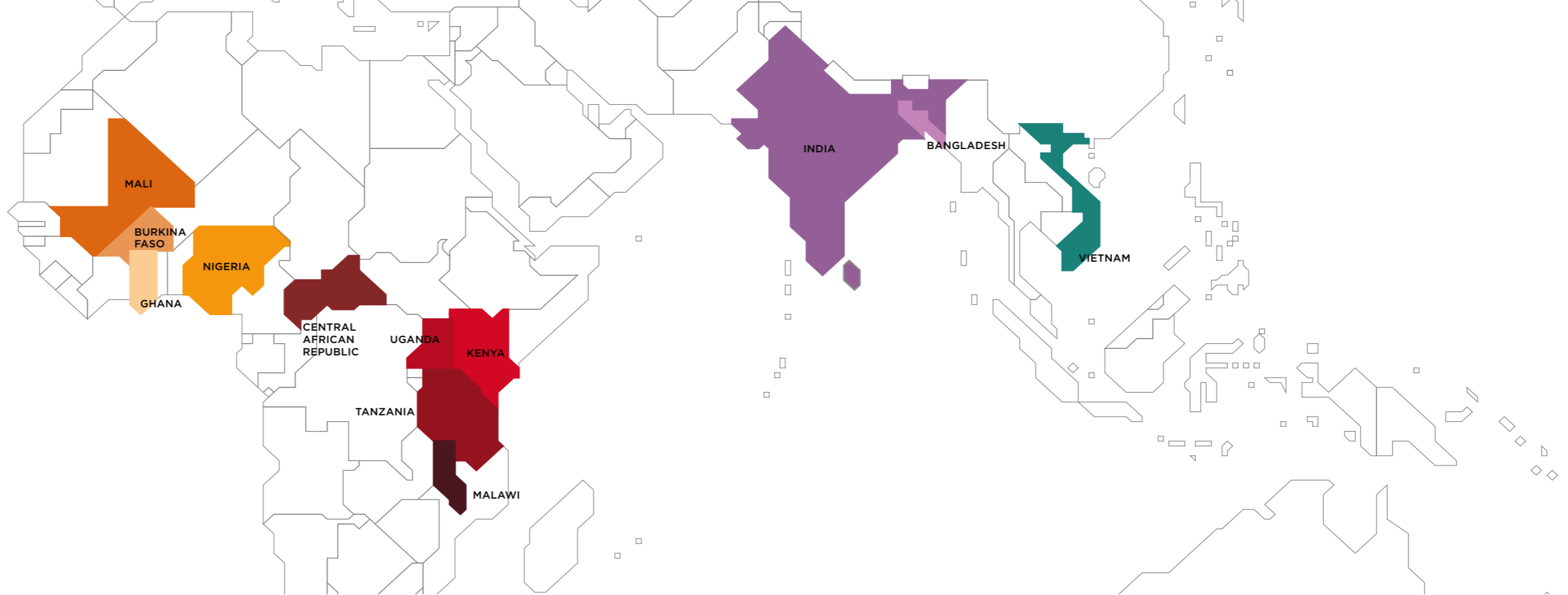
105. CEI Africa (2023). [CEI Africa announces intent to award first RBF grants.](#)

Spotlight 12

nLine pioneers grid monitoring as a service with Millennium Challenge Corporation in Ghana and Senegal

Critical infrastructure auditing company nLine aims to scale its monitoring-as-a-service model. The standard PowerWatch sensor, equipped with a global eSIM, plugs directly into any AC outlet, sending continuous information on voltage, frequency and outages to a central data warehouse. By pairing this cloud-connected outlet-level sensor with advanced back-end algorithms and visualisation tools, nLine provides measurements of power quality and reliability KPIs for customers. Through an initial partnership between the Ghanaian government and the Millennium Challenge Corporation for the evaluation of the Ghana Power Compact, nLine's monitoring service has now expanded to evaluating the Senegal Power Compact and beyond to East and Central Africa. It now covers grid, off-grid, and healthcare electrification performance monitoring sectors. In the electricity vertical, this granular, near-real-time, and ongoing performance evaluation is essential for evolving RBF schemes beyond the dominant connection-based model toward energy-as-a-service models. This evolution can incentivise operations and maintenance (O&M) providers to meet modern standards for quality and reliability, especially in critical areas like healthcare electrification.





NG

Odyssey's platform provides a one-stop shop for managing Nigeria's Results-Based Finance National Electrification Plan

In Nigeria, Odyssey is facilitating the off-grid sector's largest government financing programme to date (\$350M), funded by the World Bank. The platform has developed hundreds of feasibility studies for sites based on millions of data points in rural communities. This data is being used to manage a minimum subsidy tender, a mini-grid RBF programme, and a solar home system RBF, all using digital technologies to streamline the process. The data platform integrates with all major customer relationship management (CRM) systems for the off-grid energy space, including Solaris, Angaza, Upya, Paygee and more. Advanced analytics are then applied to customer and payment information that can be cross-referenced to verify disbursement triggers. Based on these inputs, without any involvement from the renewable energy company/developer, the platform can verify that connections are up and running. Odyssey has partnered with major electronic payments provider Remita to streamline the disbursement process.

- DIGITAL PLATFORM + APIS + IOT (SMART-METERS)
- MASS-PAYOUT FINTECH
- ENERGY (STANDALONE PV, MINI-GRIDS)

NG UG

A2EI's Prospect platform aggregates granular data from distributed energy assets that can tap into climate finance

A2EI is trialling a global transaction platform for climate impact payments to radically reduce carbon emissions (SDG13 + SDG7). The RBF tool incentivises companies to reach unserved populations with off-grid sector technologies by increasing energy access, reducing carbon emissions and increasing productivity. Under this arrangement, financing is automatically triggered only after the installation and performance of the product has been monitored. Five OGS companies—Bboxx, ENGIE Mobisol, Victron, SunCulture and Lorentz Pumps—tested the platform for productive use appliances along with A2EI's own products. The trial has informed the data processing needs required and is now being commercially tested through A2EI's 'solar generator' products across Nigeria.

- DIGITAL PLATFORM
- + APIS + IOT
- PRODUCTIVE USE ASSETS (SOLAR GENERATORS, ECOOKERS, SOLAR WATER PUMPS)

IN

ixo Foundation leverages distributed ledger technology, IoT, and AI to verify SDG impacts

ixo collaborated with the UBS Optimus Foundation to demonstrate how programmable capital mechanisms can be used to implement development impact bonds in the context of the Quality Education India DIB, which aims to improve literacy and numeracy among 200,000 school children in India. The intent is to demonstrate that this RBF instrument can be unitised and decentralised to the level of individual intervention sites (schools, in this instance) to enable bottom-up origination and scaling. The demonstration project focuses on having impact data captured in a high-definition standardised format, with verification results recorded for posterity and transparency.

- BLOCKCHAIN/DISTRIBUTED LEDGER TECHNOLOGIES, AI AND ADVANCED DATA PROCESSING
- DIGITAL TOKENS
- EDUCATION, ENERGY (COOKSTOVES)

GH ML BF UG TZ CF MW BD IN

Uptime delivers results-based subsidies to rural water providers based on a blend of digital and manual data integrity processes

The Uptime Catalyst Facility, a UK-registered charity, issues non-repayable funding (smart subsidy) grants ranging from \$5,000 to \$400,000 annually to rural water maintenance providers. Funding supports providers' OPEX as a function of the reliability of the water systems' availability, volumes disbursed, and sales. The first multi-country pilot for results-based funding of rural water services was launched in October 2020, and today works with more than 12 providers in 12 countries serving an estimated 1.5 million rural people. Verification of results takes place in the form of audits of quarterly standard Excel spreadsheets quantifying volumes of water dispensed as well mobile money revenues received from providers. A major bottleneck to scale is rural providers' stage of digitisation; while three quarters use some form of automated technology for measuring volumes disbursed and breakdown rates, only a quarter collect funds through mobile money. Another challenge to scale is that rural water providers rarely have the two years of historical data required to backcheck quarterly submissions of performance. The initiative aims to transition towards a public-financing model through its expansion to Asia and Latin America.

- IOT (REMOTE SENSORS)
- MOBILE MONEY & PAYG DATA
- RURAL WATER

VN

EnDev's biogas RBF project employs mobile-based digital app to trigger payment through photographic verification

In Vietnam, EnDev's RBF project expanded upon a prior government initiative to enhance biogas demand. While biogas companies struggled with competitive business practices, EnDev's 2013 project aimed to transform this by focusing on supply-side improvements. Central to this transformation was a digital GPS-based tool that played a pivotal role in the project's RBF. This tool allowed biogas entrepreneurs to validate their work through real-time data collection and photo verification of installations. Once an independent quality controller confirmed the installation's quality through the app, payments were triggered to the entrepreneur's account. Given the tool's importance, training was offered to ensure widespread adoption and effective use among entrepreneurs.

- DIGITAL PLATFORMS + SMARTPHONES
- ENERGY (BIOGAS)



Spotlight 13 African and Asian payment ecosystems

Though streamlined payment disbursements across Africa and Asia were cited as a major hurdle in many stakeholder interviews, mass payouts across multiple geographies using mobile money and other digital wallet platforms are on the cusp of maturing. In Africa, companies like MFS Africa and the Pan-African Payment and Settlement System (PAPSS) are building and enabling cross-border financial market infrastructure to facilitate disbursements across the continent. A new regional cross-border payment system recently implemented in the ASEAN bloc hopes to ease payment settlement in Indonesia, Malaysia, Thailand and Singapore.¹⁰⁶ India's digital public infrastructure stack made up of a digital identity layer (Aadhar), a digital payment layer (UPI), and a data layer (DEPA) has transformed the country's digital ecosystem and is being widely adopted across other countries in the region. The Unified Payments Interface (UPI), an open API-based instant-payment system introduced in 2016, has allowed private entities to leverage it for innovation and new service offerings. In 2022, the UPI platform facilitated over 74 billion transactions, amounting to \$1.5 trillion through mobile apps such as PhonePe, Google Pay, and WhatsApp.¹⁰⁷ It is estimated that almost a third of loans for MSMEs in India are obtained through fintechs.¹⁰⁸ Asian fintechs are also offering powerful cross-border payment solutions coupled with services like FX risk management, cloud-native technology platforms and API integrations to facilitate B2B and B2C transactions.¹⁰⁹

African economies with mature financial distribution networks alongside high penetration of mobile money and digital infrastructure were, unsurprisingly, host to many in-scope use cases identified. Enablers for these countries include increasing smartphone ownership, declining internet costs, expanded network coverage, and a young and rapidly urbanising population. In Nigeria, for example, the success of dedicated financial service providers like Flutterwave, Paga and Verto have unlocked innovative investments into the e-mobility and merchant finance space. Activity in these countries was driven by strong growth in the last-mile financial services market, which is growing at about 10% annually on the continent, with the potential to reach \$230 billion in revenues by 2025.¹¹⁰

Across use cases discussed in this report, there are cross-cutting technology trends underpinning the shape the market. While innovation in financing instruments and transaction mechanisms constitute critical enablers of a use case 'completing the loop' in terms of achieving the sustainable deployment and return on investment of capital, it is often the digitally-enabling technology that serves as the bridge, and their overall evolution provides important context on opportunities for the growth of utilities sector enterprises.

The deployment opportunities and viability for innovative finance instruments across disparate use cases depend on several interrelated drivers. These drivers are often principally enabled by

the incorporation of digital technologies, but such developments are rarely sufficient in and of themselves to bring about use case maturation and scaling. Advances in innovative transaction mechanisms, creative partnerships, and supporting sectoral and regional developments all play a supporting role. Use cases that have come together for relatively mature innovative finance instruments are digital platforms paired with IoT, satellite technologies, and PAYG services. These have contributed to the maturity of crowdfunding in energy, the recent emergence of large receivables financing arrangements for SHS in Africa, and alt-lending around the world for agritech and supply chain finance.

106. CNBC (2023). *Southeast Asia moves closer to economic unity with new regional payments system*

107. World Bank (2023). *India's digital transformation could be a game-changer for economic development*.

108. Ziegler, T. et al. (2021). *The 2nd Global Alternative Finance Market Benchmarking Report*. Cambridge Centre for Alternative Finance.

109. McKinsey (2023). *How Asian banks can regain the cross-border payments crown*.

110. McKinsey (2022). *Fintech in Africa: The end of the beginning*.

4.1 Technology developments

Technologies and their combinations only find application in real-world use cases. The use cases that have successfully raised or deployed capital in innovative ways are those that manage to put together the right combination of technologies in service of solving a real-world use case. For instance, clean cooking company ATEC combines digital payments, remote monitoring, and digital verification technologies to subsidise access to its IoT e-cook device to low-income customers in Bangladesh by generating carbon credits under Gold Standard's new 'metered methodology'.¹¹¹ Meanwhile alt-lending platforms such as **Jumo** through its Unify product or revenue-share platforms such as GetVantage combine AI and big data to make lending decisions to early-stage companies based on in-house algorithms. Decreasing costs of IoT hardware and higher smartphone and e-wallet penetration enable strong growth in embedded finance-enabled revenue sharing models. The rise in supply and demand for such models will parallel the maturity of certain key sectors like electric mobility and electric cooking, which will simultaneously be able to tap into climate finance and receivables financing. Asset tracking in real-time will allow for small businesses to leverage their revenues as collateral, mitigating the need for formal collateral and potentially unlocking additional access to capital.

- **Digital platforms** offer flexibility in integrating data-streams, making them an integral part of many social enterprises' operations. APIs further enable multiple types of software-based integrations to consolidate and streamline different actors in a given sector. This contributes to the densification of ecosystem actors in a way that supports partnership opportunities. Amini, for example, is an early-stage Africa-focused data aggregation platform that processes weather, sensor and farmer data down to a square metre, providing land-based data via APIs to local and international companies seeking to add geospatial intelligence to their offerings.
- **Digital platforms' data integration intersects with the rise of IoT monitoring.** Several of the world's largest carbon certification registries like Verra and Gold Standard are in development stages for integration functionalities to facilitate the automated verification of carbon credits from distributed assets and devices. Electric cooking devices and induction stoves are among the first to access such finance, with projects like 4R Digital's Carbon Value Exchange Platform and

SunCulture applying the same combination of technologies and innovative finance to increase the affordability of productive use assets like solar water pumps. IoT monitoring is also a key enabler of other digitally enabled financing instruments such as RBF. The work of Odyssey has demonstrated that IoT monitoring can help address implementation, verification and disbursement challenges commonly associated with RBF programmes and enable greater speed and scale.¹¹² IoT monitoring is also a key catalyst for receivables financing as it underpins the PAYG model. With IoT ecosystems in LMICs projected to continue growing rapidly over the coming decade,¹¹³ it will be key for early-stage companies to invest in both the right hardware and software underpinning IoT monitoring so that they can benefit from associated innovative financing opportunities. For funders, it will be key to explore opportunities of blended finance associated with IoT monitoring to collaborate across different financing instruments and types of funders leveraging the same monitoring platforms (for instance by coupling RBF with climate finance).

- **AI holds catalytic promise for the utilities sector, from grid optimisation and predictive maintenance to demand forecasting and customer engagement.** Particularly in areas with poor infrastructure and connectivity, AI offers opportunities to optimise distribution, collect data and query customer requests automatically. Ultimately, AI can enhance the quality of utility services and improve their cost-effectiveness and scalability across emerging markets. From an investment perspective, AI makes it easier to offer data-driven insights and enable evidence-based decision-making. Potential applications for AI in the energy sector are illustrated in Figure 4.
- **Blockchain's** long-hyped emergence has found product-market-fit in the monitoring of climate finance as well as supply chain coordination. A slew of carbon finance companies are working to solve the thorny challenge of multiple-counting of impact credits using blockchain, providing one of the strongest examples of the technology's application across sectors. In addition, several sectors are seeing emerging and mature blockchain applications that include cross-border logistics and agricultural insurance. **Arbol**, for example, provides parametric indexed weather insurance to farmers through Ethereum-based blockchain contracts.

111. GSMA (2023). *ATEC and ENGIE sign a digital carbon credit agreement.*
 112. GSMA (2023). *IoT and Digital Payments: A game changer for results-based financing?.*
 113. GSMA (2023). *IoT for Development: Use cases delivering impact.*

- **Tokenisation**, the process of converting rights to an asset into a digital token, can also address some unique challenges of emerging market utility services. With limited access to traditional banking services, tokenisation can provide new ways to manage and trade assets for consumers through bill payments and cross-border remittances, peer-to-peer energy trading, property ownership to be leveraged as collateral, and water or energy usage tracking and management. Tokenisation also provides the ability to divide investments into smaller pieces, making less commercially viable investments more affordable and accessible to a wider range of potential financiers that may have not been able to participate through more traditional channels.
- **Combinations across multiple technology clusters are also increasingly employed by use case implementers.** **South Pole's** D-RECs, for example, leverage blockchain technology in the generation of verified carbon credits for solar electricity generation based on their digital platform's API integrations with major inverter manufacturers' remote monitoring systems. Similarly, **DiMuto's** digital platform for agricultural trade and finance leverages IoT, cloud, blockchain and AI to track and finance the movement of goods across multiple Asian markets. The increasing maturity of each of these technologies over the past several years has made off-the-shelf solutions more easily accessible to social enterprises judicious enough to identify, select, mix and match emerging solutions rather than develop each in-house.

Spotlight 14 The GSMA's open API initiatives

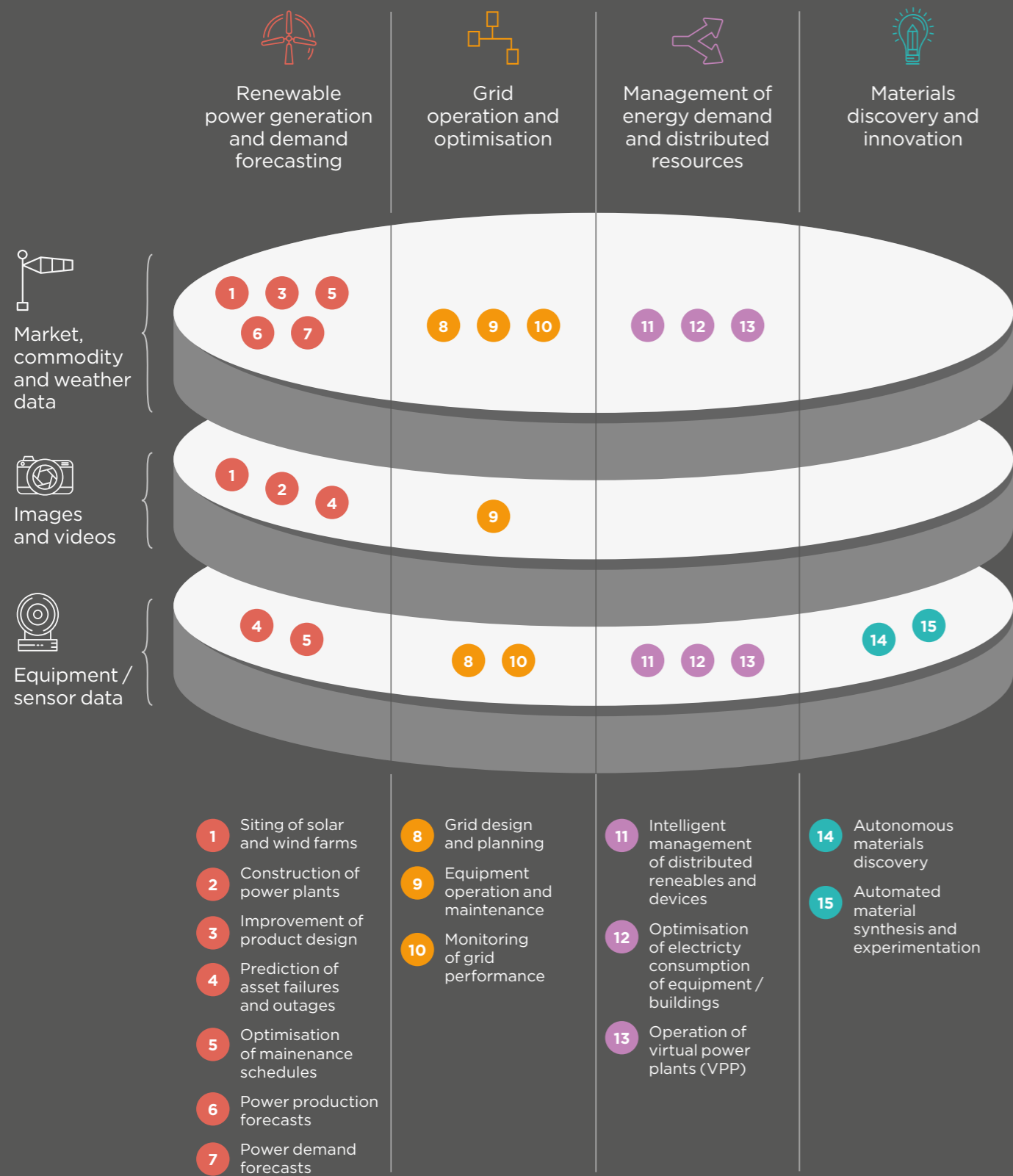
The GSMA Mobile Money API was created to confront challenges faced by the mobile money industry to harmonise technical language and facilitate easy integration between mobile money providers and organisations who want to interface with these providers. Key use cases include bill payments, international and P2P transfers, disbursements and account linking, which all have important applications for the utility industry.

The GSMA Open Gateway initiative aims to accelerate industry support and collaboration to build new digital services. The Gateway is a framework of common APIs designed to provide universal access to operator networks for developers. Launched in 2023 with 21 MNOs, the initiative will help technology companies and social enterprises access resources and systems to build digital services quickly and effectively.



Figure 9

AI applications in the energy sector by type of data



Source: WEF (2021).



4.2 Sectoral developments

- KEY TRENDS
- INNOVATIVE DEVELOPMENTS AND USE CASES



ENERGY

Across sectors and geographies, energy solutions dominate, accounting for over a third of all use cases identified in the landscape. This trend is most pronounced in the mature PAYG standalone, rooftop mounted photovoltaic (PV) vertical, also known as solar home systems. RBF initiatives leveraging digital verification of connection sales are emerging for mini-grid providers, though still in developing phases, while clean cooking initiatives tapping into climate finance have also shown strong growth.

- RBF has the potential to disrupt energy sector subsidy schemes by shifting towards energy-as-a-service models. The expansion of digital platforms, combined with digital monitoring and verification, could allow for a more streamlined and transparent energy supply chain disbursement for RBF, particularly as payment processing is integrated into tracking platforms.
- Distributed Ledger Technology (DLT)-based smart contracts could help ensure more efficient verification and disbursement processes.
- The sector is likely to continue benefiting from climate finance, given the growing opportunity to further commercialise energy savings through carbon credits.
- Crowdfunding and financial aggregation is likely to continue attracting capital for renewable energy projects, particularly those with clear ESG benefits.

- **ImpactPPA** is a blockchain-enabled, decentralised energy platform that provides renewable energy solutions to remote and underserved areas across Asia. Through Power Purchase Agreements (PPAs) using smart contracts, investors can track the impact and returns of their energy investments. Built on the Ethereum platform, ImpactPPA plans to sell its security tokens, which will provide investors access to the platform's revenue streams and the sale of electricity and assets.
- **The Sun Exchange** is a peer-to-peer solar leasing platform. Through its marketplace, investors can purchase part of a solar cell, which makes up a solar panel, and lease them back to schools, hospitals and businesses across Africa through blockchain-based transactions. The returns are generated on a monthly basis and distributed among owners proportionally. This model has been replicated by other companies like Momint, who have taken the platform a step further by integrating open APIs and fractionalised assets through digital tokens beyond only energy projects.



NATURE-BASED SOLUTIONS

A significant amount of innovative, early-stage activity is emerging around nature-based solutions at the intersection of farming and environmental stewardship. These include, for example, aiming to achieve environmental objectives such as biodiversity conservation or landscape restoration.¹¹⁴ Such initiatives leverage the methodologies of VCMs in generating certificates of impact tied to verifiable outcomes, most frequently employing satellite-based remote verification methodologies or distributed ledger technologies. Agritech use cases account for roughly a quarter of the landscape across geographies, leveraging several digital technologies in the provision of not only credit and input financing but advisory and insurance services to mitigate risk and connect to global markets.

- Climate finance is projected to continue growing, potentially making this one of the largest sectors for venture capital and philanthropy in Africa and Asia.
- DLT-based protocols could improve the auditing of carbon trails, thereby enhancing the quality of carbon credits.
- The growth of digital platforms could also help streamline climate solution projects, and financial aggregation, combined with crowdfunding, might attract patient capital for projects with strong environmental and social impact.
- Digital monitoring and verification will increasingly become the standard modality for accessing carbon finance via APIs automatically connecting IoT device data directly to verification bodies' platforms. AI will be used to audit and verify big data produced by these data-sets.

¹¹⁴ GEF (2023). *Innovative Finance for Nature and People: Opportunities and Challenges for Biodiversity-Positive Carbon Credits and Nature Certificates.*

- **Acorn** is an agroforestry programme that uses satellite monitoring to track carbon sequestration through biomass growth. Operational in 10 African countries, Acorn facilitates smallholder farmer participation in its technology-enabled marketplace to access international carbon markets, combating climate change, land degradation and food insecurity.
- **TruTrade Africa** is a mobile-enabled trading platform in Uganda and Kenya that leverages digital technology to enable collaborative and more efficient supply chain management, digital data collection, carbon footprint assessment, and carbon market access, among other key benefits.
- **Empower.eco** issues plastic credits that fund plastic waste cleanup while creating employment for the marginalised. Corporates like Dow Chemical Company buy credits through subscription packages which fund cleanup projects in Africa. Blockchain-enabled tracking facilitates the certification, standardisation and sale of plastic credits on the global market. Tracking also includes photographic evidence of each cleanup so that plastic credit buyers have a tangible way to verify and communicate their impact to the world.¹¹⁵

¹¹⁵ Process WorldWide (2021). *Dow, Empower, Norad to Hold Feasibility Study for Plastics Circularity.*

¹¹⁶ TechCrunch (2023). *YC-backed Eze raises new capital for its secondhand electronics marketplace.*

¹¹⁷ Azo Cleantech (2021). *How Digital Solutions Could Tackle Post-Consumer Waste in Developing Countries.*



WASTE, SANITATION AND RECYCLING

Several use cases of digitally enabled innovative financing were identified in the waste, sanitation and recycling sector. Waste and recycling initiatives, accounting for roughly one-tenth of the use cases identified, have leveraged multi-sided app-based models connecting distributed collector agents with aggregators, often employing wallet-based mechanisms to facilitate transactions for sorting products for resale both domestically and internationally.

- Technologies underpinning multi-sided digital platform providers that connect aggregators will scale from cities to countries to regions.
- Integrated digital payments drive financial inclusion, leveraging various forms of alternative currencies.
- Growth in secondary electronics markets that trade cross-border will attract investment capital for operators requiring financial solutions.
- Corporate focus on waste reduction in the supply chain, in the context of extended producer responsibility (EPR) legislation.
- The use of digital platforms, IoT and advanced analytics will incrementally improve operational efficiency of sanitation models.

- **Eze**, a B2B marketplace that enables global electronic wholesalers to trade devices in large quantities across global markets with real-time market data, leveraging digital technology to improve distribution, pricing fragmentation and fraud across the recycling sector. The company raised \$3.7 million in an oversubscribed seed round in 2023, signalling promise for similar business models to emerge.¹¹⁶
- **Sanivation** is a container-based sanitation provider that partners with local governments to optimise planning and waste management in Kenya. Recently spotlighted in a [GSMA blog](#), the company received a [GSMA innovation grant](#) to digitise operations to further progress its mission through PPPs and explore opportunities for outcome-based payments through carbon credits.
- **Kabadiwalla Connect** is an Indian waste management company that provides decentralised waste collection and processing solutions for cities. Using IoT, the company integrates informal actors into the formal waste management system through B2B solutions like geospatial mapping, transactions-based digital tracking of supply chains, and waste collection. Kabadiwalla Connect's pilot project created a PoS device for a Chennai scrap shop to register waste pickers as suppliers and authorise their transactions.¹¹⁷
- **ReCircle**, a brand of Swachh Sustainable Solutions, are building a digital platform that aggregates the collection and processing of dry waste to sell EPR credits to businesses, such as Hindustan Unilever Limited, and Dabur in India. The platform brings together individual household-level waste collectors (also known as raddiwalas/kabadiwalas in India), large-scale waste aggregators, recyclers and processors, and will be launched across India, digitising ReCircle's existing supply chain across 102 cities, towns and villages.



WATER

Proportionally few instances of digitally enabled innovative financing in the water sector were identified across the landscape. The water sector has historically struggled with commercial viability, and will continue to require more grant funding and blended financing options to accelerate access. According to the World Bank, water providers that collect only 70% of their tariffs or have non-revenue water rates of 40% are not financially viable or creditworthy.¹¹⁸ Private sector mechanisms for investing in water are hindered by challenging regulatory and market fundamentals in the municipal water sector and slow adoption of digital technologies for rural water providers with sparse historical operational data. Most digital technologies in the water sector tend to focus on internal operations, identifying system losses, and digitalising customer relationships. Stakeholder interviews reveal that at least two years of operational data would be required to access data-driven innovative financing in this sector.

- The gradual maturity of standardised billing systems or IoT-based dispensing monitoring systems may unlock additional innovative financing models.
- RBF could make a significant impact on water projects, particularly those which are able to digitise historical and updated technical and operational data.
- The growth of digital platforms leveraging digital monitoring and verification could make the management of water resources more efficient and transparent.
- Industry stakeholders foresee state-led funding models in the long-term as they believe that funding should come from taxes via long-term subsidisation through a smart subsidy or country-specific funding model.
- The water sector is one of the main vectors through which the human-centric impacts of climate change will be felt. Water crises are consistently ranked among the top five global risks by business leaders, and many cities are grappling with the very real threat of running out of water. Within this context, the need for innovative solutions and the finance to scale them has never been more pressing. A key new area of opportunity could link the benefits of water investments to more revenue-generating sectors (such as power, food and agriculture) to monetise otherwise 'unpriced' natural capital assets (like clean water and other ecosystem services).¹¹⁹

- **Aqua for All**, a foundation aiming to support scalable solutions and capital in the water sector, has pioneered innovative partnerships with local banks in Kenya aimed at crowding in new forms of capital to the sector. In collaboration with Sidian Bank, Aqua for All launched a challenge fund targeting small scale water service providers in Kenya. With over 20,000 small piped water operators and point sources in the Kenyan market, access to capital has been a persistent challenge for these operators. The fund will provide financing solutions that align with the revenue streams of these providers.¹²⁰ Aqua for All also partnered with National Bank Kenya to introduce a KSh 5 billion WASH financing programme. The programme will offer flexible financing solutions under two different facilities, including working capital loans dubbed the 'Jenga Biashara loan' targeting small-scale providers and 'Infrastructure Project Loans' targeting household connections, smart metering, solar projects and other productive use assets.¹²¹
- **Safe Water Network**, which operates in Ghana and India, has showcased blended finance as an essential tool to help small water enterprises access debt financing, while reducing financial burdens and increasing the likelihood of repayment. Innovative loans also spurred innovation and technology adoption across SWN's portfolio, as prepaid smart meters and digital payment collection helped improve cost recovery and inform better loan terms.^{122, 123}
- **CityTaps** has developed a water utility subscriber management solution, CTSuite, which combines a smart, prepaid water meter (CTMeter) with an integrated software management system (CTCloud) to process pay-as-you-go (PAYG) payments through mobile money.¹²⁴

118. World Bank (2022). *How to improve water-sector financing in developing countries*.

119. Blended Finance Taskforce (2022). *Mobilising Capital for Water: Blended Finance Solutions to Scale Investment in Emerging Markets*.

120. Sidian Bank (2023). *Sidian Bank and Aqua For All launches Challenge Fund targeting Small Scale Water Service Providers (SSWPs)*.

121. See: <https://www.nationalbank.co.ke/about-us/newsroom/national-bank-launches-kshs-5b-water-sanitation-and-hygiene-financing-program> (accessed 15 September 2023).

122. Safe Water Network (2021). *Loan Financing*.

123. Stanford Woods (2022). *The Opportunity of Leveraging Data from Private Sector Innovators for Improved Urban Water Services: The GSMA Experience*.

124. Stanford Woods (2022). *The Opportunity of Leveraging Data from Private Sector Innovators for Improved Urban Water Services: The GSMA Experience*.



MOBILITY

An emerging landscape of asset-specific financing models was identified across the mobility sector to promote electric vehicle financing. Such models leverage maturing app-based digital ecosystems for connecting riders to drivers and embedded finance to securitise loan repayments for vehicle leasing, whereby a proportion of revenues from rides are automatically deducted from wallet-based transactions. These are however predicated on developed digital wallet ecosystems, limiting their current applicability to markets with developed end-user digital finance ecosystems and high smartphone penetration. A key challenge for the viability of the electric vehicle market is the expensive infrastructure required to support it. Working with partners to commercialise specific segments and redefining the economics of rural electrification can mitigate these challenges to provide more patient capital to build out the business, as well as providing more incentives for successful companies to expand to underserved markets.

- The widespread adoption of smartphones may lead to an increase in end-user financing for auto-entrepreneurs and SMEs.
- Revenue sharing models and receivables financing will become increasingly mainstream for vehicle and asset leasing models, particularly driven by the prevalence of embedded finance.
- Digital technologies like geospatial mapping and analytics can optimise and reduce the risk of e-mobility services, while the use of alternative data for thin-file customer profiling and smartphone-based biometric tools could also lower the barriers to vehicle and asset leasing.
- The rise of investment in EV infrastructure across Asia and Africa will likely lower prices as companies compete for market share.¹²⁵

125. African Business (2023). *New plants in Benin and Togo underpin Africa's EV potential*.

126. CleanTechnica (2023). *Bboxx & Spiro Sign Major Asset Financing Deal for Electric Motorcycles*.

127. See: <https://www.macquarie.com/au/en/impact/case-studies/financing-indias-e-mobility-transition.html> (accessed 15 September 2023).

- **Bboxx**, a data-driven super platform across Africa, partnered with Spiro, a motorcycle manufacturer, to leverage its innovative asset financing model to accelerate the delivery of electric motorcycles (e-motos). Customers can finance e-moto purchases through Bboxx Pulse, the company's integrated operating system, which offers flexible payment plans adapted to customers' fluctuating incomes. Through the partnership, customers can swap batteries and benefit from discounted connectivity and energy rates. The programme has deployed 9,200 e-motos across Benin, Togo and Rwanda, driving 80 million kilometres of emission-free journeys and two million battery swaps, thus reducing carbon emissions by 4,000 tonnes in its first year.¹²⁶
- **E2W Africa**, a financing platform for electric vehicles, provides both growth equity and small-scale asset finance for electric vehicles in East Africa. Blended finance will be used to deploy over \$5 million investments for two-wheelers, three-wheelers, charging or swapping infrastructure to overcome the charging infrastructure obstacle, and small-scale manufacturing, primarily final assembly.
- **Macquarie**, in partnership with the **UN's Green Climate Fund**, launched a new blended finance platform to drive the adoption of electric vehicles across India. The financing platform aims to deliver \$1.5 billion to introduce unique leasing and financing solutions to reduce capital expenditure and infrastructure constraints across the country. Initially focused on selected segments such as e-buses, shared fleets and charging infrastructure, the platform will expand to other e-mobility sub-sectors as the market scales. With a 10 year implementation period, the platform is expected to deliver lifetime reduction of around 9.5 MtCO_{2e} of GHG emissions.¹²⁷
- **BasiGo** offers electric buses to Kenyan bus operators through a Pay-As-You-Drive financing solution, which allows public bus owners to purchase electric buses for the same upfront cost as a diesel model. Through this approach, BasiGo plans to deploy over 1,000 locally assembled electric buses in Nairobi over the next five years. All Pay-As-You-Drive subscriptions come with free charging at BasiGo charging stations.
- **OTO Capital**, in collaboration with Hero Electric, is offering electric two-wheeler financing solutions to B2B partners and riders in India. Its fintech platform uses a sophisticated data-drive strategy to make quick loan decisions to prospective customers.



5

Structuring partnerships and recommendations to key stakeholder groups

5.1 Partnerships

Partnerships are critical to enabling digital innovation, as technology adoption often involves collaboration between multiple stakeholders across value-chains and ecosystems. Digital innovations allow social enterprises to expand service reach, improve service quality, complement expertise and resources, and distribute risk. They also enable these enterprises to transparently share data, and track records with multiple partners enabling new partnerships, and approaches.

Although digital technologies may create new opportunities for impact, it is just as often the right combination of collaborating funders and their commitments that constitute true innovation, resulting in the emergence of financial structures that can support social enterprises across the utilities ecosystem. Notable types of partnerships identified through this research included those between: 1) Fund managers and local banks; 2) Fintech platforms providing debt financing solutions to social enterprises and SMEs; 3) Government agencies, donors, fund managers, and private sector IoT platforms; 4) Corporates and SMEs; and 5) Grant-making entities/concessionary finance providers and return-seeking investors.

Partnerships between fund managers and local banks often include first-loss guarantees to address local banks' low risk appetite for participating in novel lending plays or sectors. Emerging markets-focused fund managers such as **Lion's Head Fund** and **GreenMax Capital Fund**,¹²⁸ for example, have been critical providers of risk mitigation guarantees that have enabled some of the largest receivables financing plays in the energy sector to date. Though not explicitly digital themselves, first-loss guarantees have proven vital to enable local banks to provide much needed local currency debt financing to tech-enabled businesses that are typically considered too risky. These partnerships are critical to establish

local banks' expertise and capabilities to extend their reach to emerging use cases and create pathways to deepen their engagement.

Partnerships involving fintech platforms have proven a dynamic mechanism by which distinct value chain solutions can be paired. Private sector collaborations focused on profit or revenue sharing can leverage the comparative advantage of specialists to unlock sector-specific value and scale, while providing early-stage innovators with little collateral access to working capital to expand operations and establish a track record. A prime example can be found in the partnership between fintech **GetVantage**, one of India's most prominent revenue-based financing platforms, and cleantech businesses such **BluSmart**, **Charge Zone**, **EMotorad**, **Buyofuel** and **Verve Renewables**.¹²⁹ Another example is **Untapped Global's** smart asset financing model, which finances productive use assets for entrepreneurs and SMEs in Africa and Latin America as exemplified by its partnership with **Solar Taxi**, which aims to make e-bikes affordable to riders in Ghana.

Partnerships between government agencies and private sector players in RBF provide exciting templates for replication. Rural electrification agencies, regulators and ministries of energy can leverage learnings from existing programmes in creating platforms that fulfil multiple functions for service providers implementing targets: Site selection, procurement and financing. In Nigeria, the partnership between the Rural Electrification Agency and **Odyssey** is arguably the leading eRBF programme, and covers pre-feasibility analysis, tendering, and even disbursement through local fintech **Remita**.¹³⁰ With data-driven integrated energy planning strategies and RBF becoming critical tools in coordinating and accelerating investments in energy access, there is considerable potential for digitally enabled RBF programmes across multiple countries facing high energy access gaps. Fund managers such as **Triple Jump**,

128. CLASP (2022). **GreenMax Capital Group and CLASP Launch Green4Access First Loss Facility to Drive Uptake of Renewable Energy Solutions in East and West Africa.**
129. The Economic Times (2022). **GetVantage backs cleantech companies with \$5 million non-dilutive capital on its marketplace.**
130. ESI Africa (2023). **REA Nigeria invites bids for development of solar mini-grids.**

GreenMax Capital Advisors and Persistent also play a key role in supporting innovative RBF programmes. Clean Energy and Energy Inclusion for Africa was established in 2021 by KfW on behalf of the German Federal Ministry for Economic Cooperation and Development to co-deploy loans, equity and grants to support decentralised energy solutions. **Triple Jump** acts as the Foundation Manager, **Persistent Energy Capital** is the Crowdfunding window lead, and GreenMax is the RBF window lead, with Odyssey playing a key role in auditing outcomes to unlock RBF funds.

Partnerships between large companies and SMEs provide a template to convert multinational corporations' purchasing power into last-mile access. The collaboration between Unilever and Jaza Duka provides an interesting example of leveraging the power of big data to overcome the credit and collateral limitations of SMEs. This collaboration, expanding from Africa to Asian markets, incentivises small shopkeepers to fulfil orders using a dedicated app from the FMCG giant, which in turn converts usage data into credit scoring to disburse inventory finance. The initiative, supported by Mastercard, demonstrates an example where large organisations from the financial and commerce ecosystem can join forces to ecosystem-build in an inclusive manner that generates last-mile utility with scalable potential.¹³¹

Partnerships between grant-making entities and return-seeking investors can enable innovative blended finance mechanisms, bring in new funders to support emerging use cases, and can support the development of financial platforms with significant development potential. As concessionary development finance, public development resources, and philanthropic resources are limited, it is critical that funds that are deployed crowd in participation from the private sector and make impactful development use cases such as utility service delivery a more investible asset class. First-loss guarantees, mezzanine finance and similar instruments are gaining momentum across sectors.¹³² DFIs have a unique role to play in supporting new players, such as local banks supporting impact-focused social enterprises

in LMICs. It took catalytic capital from DFIs to mainstream off-grid solar receivables financing and secure commercial bank participation, with the US International Development Finance Corporation anchoring d.light's first securitised debt facility and British International Investment supporting Sun King's most recent securitisation deal.¹³³ Other impactful donor funding initiatives aimed at driving financial innovation can be smaller scale, but can also have a significantly catalytic impact. UNDP's Climate Aggregation Platform Innovation Challenge promotes the scale-up of financial aggregation for small-scale, low-carbon energy assets. Providing early patient capital to different commercial funders and platforms to test the feasibility of novel financial innovations can help unlock new sources of financing for use cases such as off-grid and on-grid solar, mini-grids, productive use appliances, e-mobility and clean cooking.¹³⁴ An area of particular interest is blending different types of financing instruments and collaborating across different funders on a common digital platform. Technologies such as IoT monitoring and digital payment histories play a significant role in enabling different financing instruments and co-deploying different financing instruments could raise the return on investment for funders, while also making it easier for early-stage companies to attract innovative financing without having to adhere to diverging sets of complex data and reporting requirements.

In addition to blended financing, more flexible investment structures can unlock access to capital. Another mechanism gaining in popularity to mitigate access to finance challenges across the utilities sector is convertible grants, which is a form of financing that combines elements of both grants and equity. Typically, a DFI or philanthropic investor may offer funding in the form of a grant, but it can be converted into equity under predetermined conditions. This form of innovative financing has proven successful in providing early-stage support for enterprises with social impact potential. Social Impact Bonds can also work well in certain scenarios by removing some risk to governments and more risk-averse investors, but still require an ecosystem approach to define metrics.

5.2 Recommendations

As the report highlights, digital technologies have the potential to transform access to innovative financing for social enterprises across a range of mature, emerging, and nascent use cases. Different stakeholders across the public and private sectors, donors, and philanthropic organisations can take a number of actions and collaborate to ensure that impactful innovations in LMICs can access adequate financing solutions at scale, while also raising the return on their investments and commitments. We discuss the priority actions with references to three overarching challenges for the sector.

CHALLENGE 1: Blending social and commercial objectives while accelerating missing middle investments

Policymakers and regulators should encourage financial innovation by taking a test-and-learn approach and identify institutional and regulatory barriers that constrain bankable project pipelines. Phasing-in regulations as emerging use cases grow and mature and adopting regulatory sandboxes for novel financial innovations can encourage financial innovation, enables regulators and policymakers to adequately assess the potential risks and opportunities associated with different innovations, and can attract investors and enterprises interested in exploring innovative use cases. Sandboxes are a valuable tool for developing evidence about new use cases and can help assuage or confirm regulator concerns about the impact of innovations, allowing innovations with strong developmental returns to scale and reach the marketplace. It is equally important for policymakers to continuously engage investors and enterprises interested in driving digitally enabled innovative financing through joint forums and working groups approaches to better understand what enabling environment interventions could be the most catalytic in terms of crowding-in private sector financing and allowing for more bankable projects that could benefit from blending financing.

Global corporations and investors are increasingly responsible for articulating and accounting for their social and environmental footprint, and have an interest in supporting transparent, and accessible financial intermediaries and instruments that can effectively allocate impact-oriented capital flows. There is growing scrutiny on companies to meet their ESG, and climate targets. Beyond a mere focus on the quantity of climate and social impact related investments

by the private sector, more stakeholders are now also judging these investments based on their quality, sustainability, and underlying impact. Corporations interested in fulfilling their ESG, carbon, or supply chain targets through investments in emerging markets need to recognize the difference between certified and non-certified credits. There is risk involved with participating in poor quality carbon markets, and these can come with material risks as different markets mature. To avoid the reputational risk involved with 'greenwashing' through poor quality credits, or to ensure that the social impact of different funding allocation decisions is properly assessed and monitored, corporations should invest in the development of digitally enabled financial innovations and intermediaries that can drive funding to private enterprises in LMICs, while also providing corporations and investors with valid, precise, and reliable impact metrics that can be communicated to their shareholders, governments, and other key stakeholders.

Grant funders (bilateral and philanthropic) can support enterprises in their scaling journeys through aligning reporting metrics with those used by potential commercial follow-on funders and investors. Development objectives may not always align with the objectives of commercial investment partners, creating a burden where organisations are forced to work to multiple sets of standards and requirements. Investing the time and resources into making data sharing simpler for investees can help streamline requirements across players, and free up time and space for other critical operational activities. Funders should keep track of AI and IoT applications and platforms dedicated to harmonising impact data metrics to ease monitoring burdens.

DFIs are well placed to foster sector-specific convening, learning and collaboration opportunities for blended finance. The role of digital technologies in facilitating blended finance has yet to be fully explored for addressing key challenges surrounding transaction transparency, communication and access to information. Insights from first-loss guarantee mechanisms supporting receivables finance involvement by local banks in East Africa need to be socialised and adapted to other contexts. Bringing together private and public sector actors to identify the most appropriate opportunities for blended finance instruments is essential to catalysing new investment in priority sectors or markets.

131. Mastercard (2022). [Mastercard Expands its Jaza Duka Micro-Credit Program with Kasha and Surpasses 1 Billion Kenyan Shilling in Loans to MSMEs in Africa.](#)

132. Kwon, T. et al. (2022). [Blended Finance: When to use which instrument?](#) Initiative for Blended Finance at the University of Zurich.

133. Impact Alpha (2023). [Big Solar: D.light securitizes customer loans as incumbents consolidate off-grid energy market.](#)

134. UNDP (2023). [UNDP to support seven innovative financial solutions for clean energy in East Africa.](#)

Policymakers and DFI actors responsible for the design of national RBF programmes involving enterprises can learn from the growing number of successful digitalisation initiatives. The first crop of national-scale digitally enabled RBF programmes have demonstrated the impact digital technologies have on supporting the speed and scale of programme deployment through overcoming verification and implementation challenges. These schemes offer valuable lessons for replication in other sectors and geographies. However, those designing RBF initiatives should be conscious that the lack of a long-term plan for the sectors they work in can limit interest from potential private sector participants, due to the sustainability concerns.

The full potential of the carbon markets has yet to be realised by utilities sector enterprises, but there are clear emergent opportunities at the intersection between fintech, digital monitoring, and platform services. Digital monitoring and digital platforms – such as Cync and CaVEx – for aggregating small projects have the potential to open the carbon markets to a wider set of players. Furthermore, the outcomes of the COP negotiations could bring the voluntary and the compliance markets closer together, enabling enterprises to sell to a wider set of players. Regional climate finance initiatives like the African Carbon Markets Initiative¹³⁵ offer a launch point for accelerating access to climate finance for project developers in the region.

CHALLENGE 2:
Building the technical expertise needed within organisations to support digital adoption

There are opportunities for MNOs to diversify through developing products targeted to specific utility verticals and reposition to be a tech partner rather than infrastructure provider. There is a clear emerging trend for MNOs to build tech services around core MNO services, particularly IoT where LPWAN networks have been launched. These MNO services play a key role in both centralised and decentralised utility service provision – particularly in the energy, water, and transport sectors. By focussing on utility verticals and building sector-specific expertise MNOs can position themselves as key commercial partners to support digital adoption and use their expertise to highlight emerging opportunities and trends to stakeholders in the utilities sector. The tailored

offerings of IoT business units of MNOs such as Safaricom in Kenya and Dialog across Asia are already highlighting the potential for MNOs in the rapidly growing market of enterprise IoT solutions in the utilities sector.

Donors (both bilateral and multilateral) are well placed to invest in technical assistance programmes, with a focus on digitising data processes in potential new markets. Aggregating insights and opportunities from capacity-building programmes (e.g. tech incubation programmes) dedicated to digitisation in thematic utilities sectors can create opportunities for specialist training providers, hardware/software vendors, social enterprises, and public entities to tap into novel sources of finance for technology-oriented investment opportunities.

Enterprise staff and leadership can tap into industry events and training provided by corporates, governments, and international organisations. Many social enterprises require additional technical assistance, and struggle with regulatory and operational challenges. Often additional resources and expertise is needed to navigate these hurdles. Large companies like Microsoft and Google offer programmes for local founders. Taking advantage of training for digital technologies available to local entrepreneurs and innovators can build knowledge and generate opportunities for local and international partnerships.

CHALLENGE 3:
Fully utilising the potential of digital ecosystems through driving digital adopting, and innovative use of data

This study has identified an emergent class of digital-first financial intermediaries and investors. These intermediaries operate through aggregation and the use of new data sources, and so far, the potential of this has only been trialled in just a few sectors and markets. This study has identified the opportunities that exist for replication and scaling across sectors and markets. Financial intermediaries should exchange opportunities associated with different financial instruments with key actors from other sectors and explore pathways to scale to new sectors and markets. Donors, philanthropic organisations, and corporations with a vested interest in transparent impact reporting have an opportunity to support innovative intermediary platforms that have the potential to unlock more impact-oriented capital for social enterprises.

Policymakers and regulators can encourage digital adoption and collaboration with digital innovators and social enterprises across the utilities sector. Many centralised utility service providers are struggling to meet their service mandate, fall short of commercial viability, face challenges associated with climate change, and are slow to adopt innovative technologies. By championing the role of private sector solutions and digital innovation in helping to meet those challenges, setting clear goals for digital adoption, creating an enabling environment for public-private collaboration and innovative uses of data, and introducing government initiatives in support of these objectives, policymakers and regulators can play a key role in fostering the kind of innovation and collaboration necessary to meet key societal challenges. Countries such as Kenya and India, which have particularly vibrant ecosystems for digital innovation and public-private collaboration in the utilities sector, have shown that such initiatives are not only important for improving quality and access to services, but can also enable and catalyse innovative financing.

Grant funders will continue to play an important role in testing the most frontier use cases. Long before models reach commercial viability, there is the need to develop, test, iterate, and refine the underlying technologies, and to adapt these across contexts. For many markets across the focus of regions of this study this will often require some form of grant support.

There are opportunities for MNOs and local banks to simplify mobile money, e-wallet and IoT integration processes. Many companies are still struggling to integrate into mobile money and other digital payment solutions that enable last-mile delivery and cross-border transactions. By simplifying access to APIs and creating more user-friendly processes, barriers to innovation can be removed to support early-stage startups and contribute to the overall growth and effectiveness of financial solutions in the utilities sector.

Enterprises and utility providers struggling to attract investment can benefit from investing in digitalising operations. Utilities struggle to attract investment, particularly in local currency, and therefore there is a need for additional data to support investment. Allocating investments specifically for more real-time data analytics that give line of sight into revenues and operations. This can unlock opportunities in revenue sharing with different types of financiers. Pushing for advanced digital operations can also help crowd in different types of grant financiers that can improve the investment case, as well as start the process for accessing RBF funds, climate funds, and co-benefits monetisation.

Utilities, and the partners that support them, can benefit from investing in smart metering, GIS mapping, and other digital technologies to promote good governance and efficiency of utility assets. The digital technologies that support effective management can also contribute to accessing finance. Smart meters promote billing and operational efficiencies, and GIS mapping of utility infrastructure enables utility agencies to track and analyse performance and usage, as well as more effectively manage network requirements. As well as supporting better management, these data are important to potential financiers.

Mobile operators, banks and corporates have access to extensive data that can vastly improve credit scoring and demand assessments, though broad partnerships are needed to utilise this potential while ensuring there are sufficient safeguards in place. To date there has been relatively little use of these data. Partnerships are needed to establish the regulatory frameworks around data privacy, increase ecosystem-level partnership opportunities, and crowd-source the customer insights that can support the sector in achieving broader inclusion.

5.3 Conclusions

Digital technologies have not just transformed how start-ups and early-stage innovators in LMICs operate, but they are also transforming how these organisations are financed. This research showcases a range of enabling technologies that are already playing a key role across a number of use cases, but also highlights untapped potential for emerging and nascent digitally enabled financing instruments. Given the urgency of finding more effective ways to direct funding to some of the most pressing development and climate challenges in LMICs, these instruments offer important opportunities for investors, donors, and funders to go beyond business as usual.

While discourse about innovative financing is often associated with an ever-expanding set of new acronyms, and products, a focus on impact, processes, and collaboration is far more critical. There is a tendency for certain instruments to be marketed as new, unique, silver-bullet solutions to complex development challenges. Though there are novel use cases that certainly warrant excitement, there is also tremendous potential in supporting existing use cases and approaches to work more efficiently. RBF programmes have been deployed for decades, but there are important opportunities for digital technologies to improve the speed, scale, and efficiency at which they can

135. Climate Champions / UNFCCC (2022). Africa Carbon Markets Initiative launched to dramatically expand Africa's participation in voluntary carbon market.

operate. Digital technologies also allow different funders to coordinate and co-deploy different types of financing thereby unlocking more impact at scale, while managing risks. Given the scale of funding needed to be mobilised for different sets of complex challenges, there is no one-size-fits-all solution, but there are exciting opportunities for innovation, improvement, and collaboration.

Building on the momentum in climate financing, bringing together fintech, investment, and climate stakeholders can drive transformational financial innovations. Fintech investment is consistently among the fastest growing investment classes in emerging markets, and the track record of fintech companies paired with their applications across the utilities use cases can help to support the industry and improve its risk-return profile. It is critical that innovations in fintech are channelled towards use cases that deliver development and climate impact, and utility services are uniquely positioned to deliver on both fronts.

Standardisation across platforms and data can enable partnerships and business model optimisation. Digitalisation paves the way towards greater standardisation of language, metrics and data. While there will always be differences across sectors, use cases and financing instruments, there are many opportunities for standardisation and establishing common metrics. For instance, the data platforms used in digitally enabled RBF are relevant to climate finance, monetising co-benefits, or debt finance, and vice versa. This will take more collaboration between different types of funders supporting similar use cases, and a commitment to lower burdens on early-stage companies whose internal capabilities often get overwhelmed by excessively complex and poorly harmonised reporting requirements from different types of funders.

Consistency in the core tenants of impact and profitability metrics, as well as policy and legal frameworks, can support scaling across markets. Industry associations such as GOGLA or the Clean Cooking Alliance can play a key role in bringing consistency and clarity to metrics and reporting standards. Alongside global enabling organisations such as UNCDF or the World Bank, as well as global philanthropies such as the Gates Foundation or the Rockefeller Foundation, these organisations can also work with governments and regulators to develop and share best practices on policies and regulations and create an enabling environment to test and scale innovative financing mechanisms.

Additional research is needed on the pairings of innovative finance instruments, technologies and transaction mechanisms. The most innovative use cases reviewed in this research defied easy categorisation, as they sometimes employed two or more of the innovative finance mechanisms described. Similarly, innovative organisations at various stages of their growth journeys are constantly evolving in their use of different advanced technologies. Future research aimed at informing how to maximise the developmental impact and commercial sustainability of social enterprises across utility use cases should focus more specifically on the return on investments into different financial and technological innovations, both in dollar terms as well as strategically along their scaling journeys.

Lastly, this research has revealed a need for more clear and consistent language and framing of digitally enabled innovative financing. Interviewees communicated several challenges common to working in frontier spaces, from business jargon, finance-specific concepts, technology, and fintech-specific vocabularies. These distinct languages represent an obstacle to accurately characterising various parts of the value chain. The donor community needs to leverage its role in supporting various stakeholders along the innovative financing value chain to push for more transparency to ensure that learnings are clearly communicated and disseminated. The wider ecosystem can then ensure that innovative financing instruments can maximise their development and climate impact. The hope of this research is to generate some common frameworks and terminologies that can help different stakeholders in this emerging ecosystem identify relevant challenges and opportunities and find pathways for strategic collaboration. Digitalisation will continue to transform the day-to-day operations of social enterprises and funders alike, and it is critical that the development community leverages this trend to crowd in much needed private capital and deploys existing capital more effectively to support impact-focused social enterprises.

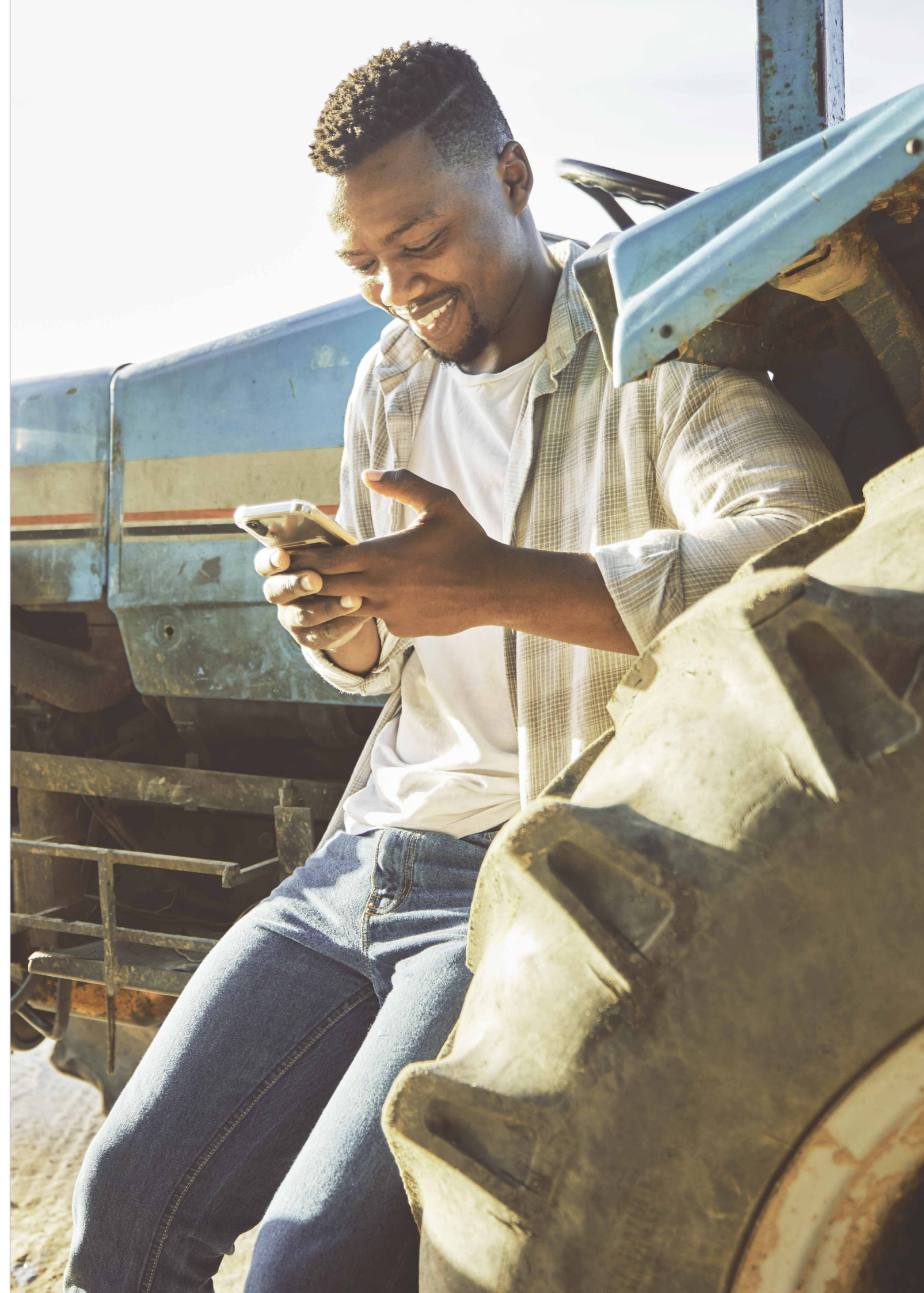
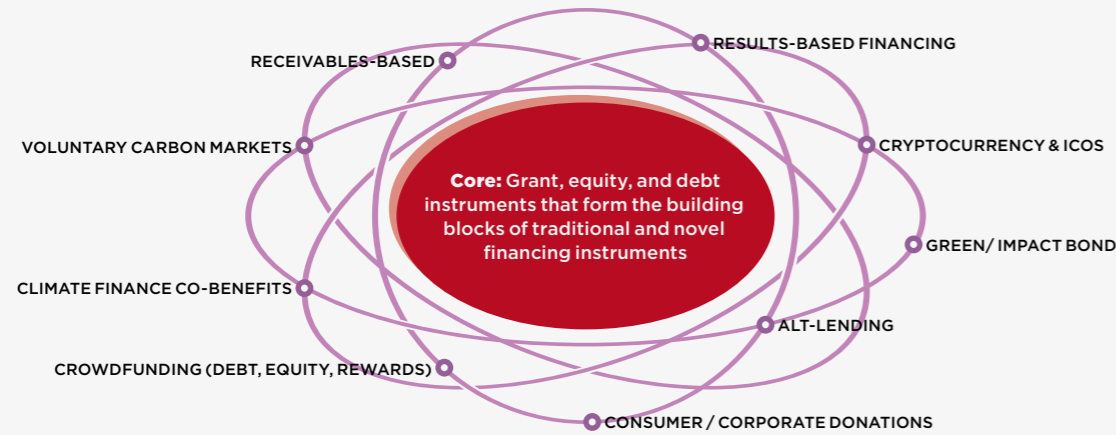


Figure 10

Lens definitions

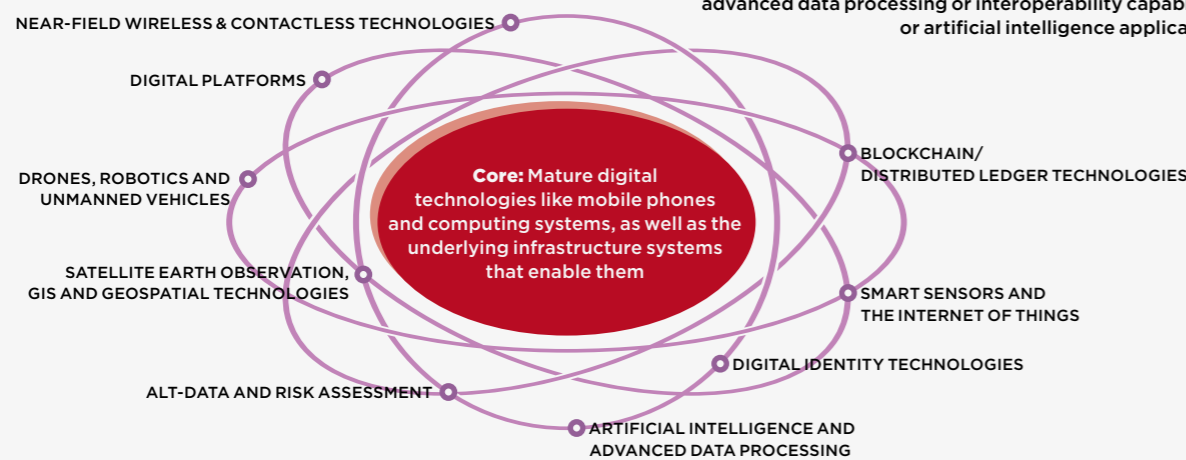
Innovative Finance Instruments

Outer edge: Modern variations that are restructured as new types instruments like results-based grant instruments, or packaged in novel combinations, as with blended finance instruments.



Digitally-Enabling Technologies

Outer edge: Emerging technologies that may be on the cusp of attaining significant deployment scale-up, such as smart-sensors and the internet of things, digital platforms with advanced data processing or interoperability capabilities, or artificial intelligence applications.



Transaction Mechanisms

Outer edge: Outer edge innovations include smartphone-enabled eWallets, multi-country or multi-wallet mass-payout services, and the variations of credit, lending, savings or insurance products that transcend the limitations or offerings of current formal banking systems in emerging markets.

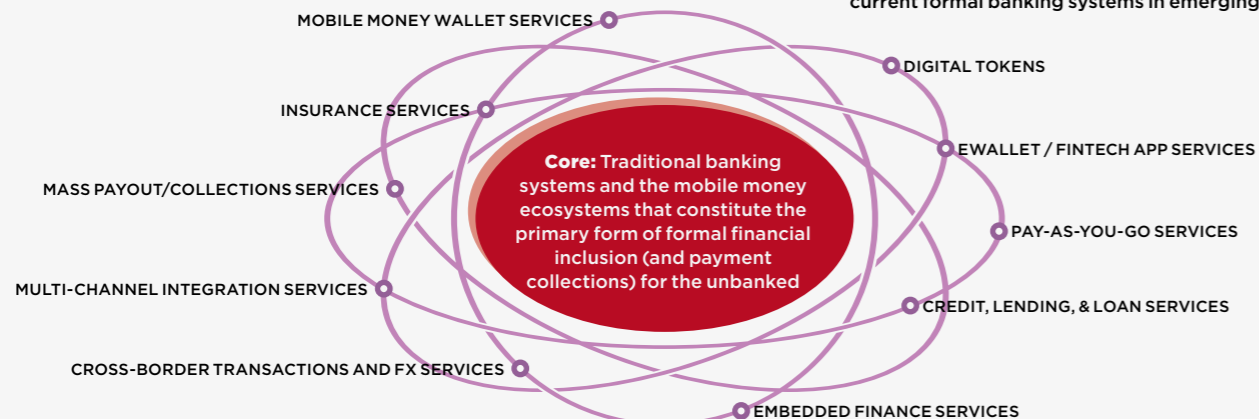


Table 1

Working definition for key terms used

Innovative finance instruments	Description
Alt-lending	Investments into social enterprises that lend directly to end-users, leveraging forms of data beyond those employed by traditional banks to make credit decisions, including mobile money transactions or other telecom data, satellite imagery, and psychometric evaluations.
Climate finance co-benefits	Price premiums or standalone certificates associated with carbon credits with verifiable social or environmental impacts beyond their emissions impact; for example biodiversity, peace, or gender impacts.
Consumer/corporate donations	Funds raised for utility service providers from consumers or corporates embedded in otherwise unrelated commercial transactions; for example where a proportion of the sales price of a product purchase is earmarked for projects with social or environmental impact.
Crowdfunding (debt)	Debt funding accessed by utility service providers aggregated through a digital platform from a variety of non-traditional investors (i.e., individuals).
Crowdfunding (equity)	Equity funding accessed by utility service providers aggregated through a digital platform from a variety of non-traditional investors (i.e., individuals).
Crowdfunding (grant/rewards)	Grant funding accessed by utility service providers aggregated through a digital platform from a variety of non-traditional funders (i.e., individuals) who may receive non-financial returns as part of their funding contribution.
Cryptocurrency & ICOs	Funds raised for utility service provider programmes or operations based on the sale of digital or virtual forms of currency that use cryptography for securing financial transactions, controlling the creation of new units, and verifying the transfer of assets.
eRBF	Results-based financing mechanisms premised at least in part on automated verification of performance indicators through digital verification; for example, leveraging sensor or metering data.
Green/impact bond	Bonds that pay periodic interest to bondholders and have a defined maturity date when the principal amount is repaid to the bondholders, wherein proceeds from sale are earmarked for projects with clear environmental benefits like renewable energy, energy efficiency, clean transportation, sustainable agriculture, pollution control, and biodiversity conservation.
Receivables-based	Working capital provided by a commercial offtaker to utility service delivery company based on the sale of a portfolio of receivables.
Revenue-based instruments	Investment mechanisms into utility service providers structured such that returns to investors are a direct function or proportion of revenues collected over a given time period.
Traditional finance	Venture, impact venture, DFI or commercial seed, equity, debt, grant or blended structure (including mezzanine financing and first-loss guarantees).
Voluntary carbon markets	Revenues generated by utility service providers based on the generation and sale of carbon credits through certified (e.g., Gold Standard, Verra, VCS) and proprietary carbon exchange platforms.

Table 2

Working definitions used for digitally-enabling technologies

Digitally enabling technologies	Description
AI and advanced data processing	Systems that can mimic human intelligence and perform tasks that typically require human intelligence like reasoning, learning from experience, understanding natural language, recognising patterns, and solving problems. A subset of AI may include machine learning and big data processing, with applications including image and speech recognition, natural language processing, recommendation systems, fraud detection, and autonomous vehicle operations.
Alt-data and risk assessment	Includes satellite readings, digital identity, mobile data and payment data for the specific purpose of quantifying different kinds of risk (insurance or lending).
Blockchain/distributed ledger technologies	These technologies use decentralised networks to create a secure and transparent record of transactions, enabling peer-to-peer exchange without the need for central authorities. Includes second-generation applications of DLT, like smart contracts.
Digital identity technologies	Systems that provide secure and verifiable digital identification and authentication of individuals, often through biometrics (e.g., voice, facial, or thumbprint recognition).
Digital platforms	Technology-enabled business models that create value by facilitating exchanges between two or more interdependent groups. Characterised by their ability to integrate different sources of data through application programming interfaces, IoT, integrate financial functionalities, and be accessible through multiple channels like desktop and mobile.
Drones, robotics and unmanned vehicles	This refers to the use of automated machines, including drones, robots, and unmanned vehicles, to perform tasks that can be dangerous, repetitive, or otherwise challenging for humans.
Near-field wireless and contactless technologies	Technologies that enable close-range communication and data transfer between devices, such as smartphones and payment terminals, facilitating seamless and secure transactions without physical contact. Includes technologies like Bluetooth, LoRA, QR codes and RFID.
Satellite Earth observation, GIS and geospatial technologies	Technologies that leverage satellites to perform monitoring and analysis of the Earth's surface using Geographic Information Systems (GIS).
Smart sensors and IoT	This involves the interconnection of devices and systems that gather data through embedded sensors and software, allowing them to communicate and interact with each other to make intelligent decisions.

Table 3

Working definitions used for transaction mechanisms

Transaction mechanisms	Description
Credit, lending and loan services	Includes digitally enabled mechanisms for providing trade, asset, or inventory financing to utility service providers, whether through automated loan disbursements, Buy Now Pay Later schemes, or upfront asset-lending. Includes values from micro-loan (e.g., for a specific asset) to working capital, but generally represented by values less than \$10,000 (e.g., not designed as seed or startup funding).
Cross-border transactions and FX services	Payment services that enable collections and distributions across national borders, including solutions for managing currency risk and remittances services.
Digital tokens	Redeemable vouchers, coupons, and various denominations of cryptocurrencies including bitcoin, CBDCs, fiat-pegged stablecoins, and secondary market cryptocurrencies whose value is not inherently Central Bank backed.
E-wallet/fintech app services	Wallet services that embed payment services within smartphone-based digital ecosystems like eCommerce, logistics and delivery, and ride-hailing.
Embedded finance services	Payment mechanisms whereby a component of digitally-transacted payments are automatically transferred among multiple parties.
Formal banking services	Includes brick and mortar as well as eBanking innovations led by formal banking services.
Insurance services	Risk-management mechanisms that collect premiums and distribute payouts based on event triggers, such as parametric weather indices.
Mass payout/collections services	Distribution and collection services designed to send and receive money from various types of transfer services, including bank accounts, mobile money wallets and digital wallets at mass-scale.
Mobile money wallet services	P2P & P2B collections/distributions functions.
Multi-channel integration services	Collection services that integrate multiple types of payments, for example bank transfers, mobile money transfers and card-based transactions.
PAYG services	Mobile money or e-wallet based systems tied for the specific consumption of utility services through mobile-based prepaid metering systems, including airtime.

Table 4

Full list of identified use cases

Implementing organisation	Use case identifier
4RD/CaVEx	CaVEx: Carbon Value Exchange Platform by 4RD uses digital verification to aggregate small projects' ability to generate carbon credits
Access 2 Energy Institute	A2EI's Prospect Platform facilitates productive use asset tracking for climate finance and RBF in Africa
Acorn / Rabobank	ACORN by Rabobank incentivises farmers to sequester carbon through agroforestry through sales of climate credits to corporates
Amini	Amini uses Geospatial data and AI to make African environmental data available by API
Apollo/Pula	Apollo and Pula partner to offer holistic agro-input, insurance, and advisory support to Kenyan farmers
Arbol	Arbol provides parametric insurance leveraging blockchain
ATEC (Engie)	ATEC generates carbon credits through IoT connected cooking devices in Africa, sells long-term contract to Salesforce
Aye Finance	Aye Finance uses AI and machine learning to provide MSME loans in India
Bboxx (DEARs)	DEARs: Bboxx and Oikocredit bring securitisation to off-grid African solar
Bboxx (TRINE)	Bboxx demonstrates speed and flexibility of crowdfunding through p2p lending platform TRINE
Bekia	Bekia's digital ecosystem and multi-sided app connects informal recyclers to solve collection issues in Egypt
Boomitra	Boomitra uses AI and satellites for Indian farmers
BoonBox	BoonBox raises more than \$2 million to expand rural e-commerce service in India
Cizo Programme	Togo's CIZO programme disburses top-up subsidies to rural end-users of solar home systems
Container-Based Sanitation Alliance	Container-Based Sanitation Alliance developing a methodology to generate Verified Carbon Credits
Credable	Credable completes India's first securitisation of a pool of trade receivable loans
Credable	Credable: revenue sharing embedded finance for asset-lending
Crop2Cash	Crop2Cash provides input financing to smallholder farmers
D-RECs (Salesforce)	South Pole develops and sells D-RECs to corporates on certified VCM exchanges
d.light (BLK 1 & 2)	Expansion of Brighter Life Kenya 1 Limited (BLK1), an off-balance sheet financing vehicle - BLK2
DigiFarm	Safaricom's DigiFarm enables digital finance for Kenyan Farmers
DiMuto	DiMuto uses 4th IR tech to enhance alternative finance access to food suppliers

Implementing organisation	Use case identifier
Empower.Eco	Empower funds plastic recycling and sorting through consumer and corporate donations, providing a digital solution for waste workers
Energise Africa	Energise Africa - Crowdfunding for Energy in Africa supported by blended financing providing first-loss tranche
EnDev	EnDev leverages app-based verification to trigger RBF payments for biogas digester program in Vietnam
Eze	Eze, a B2B marketplace that connects global electronic wholesalers allowing them to trade devices in large quantities with real-time market data, raises \$3.7 million in an oversubscribed seed round
Figorr	Figorr: IOT for reducing post-harvest losses in Nigeria
FishCoin	Fishcoin uses blockchain to increase transparency in fishing supply chain
Global Mangrove	Global Mangrove uses blockchain and satellites to verify mangrove growth
GoJek	GoJek SuperApp diversifies into microcredit lending in Indonesia
Grac	Grac supports plastic waste classification and collection and sells SaaS to Vietnamese municipalities, connecting licensed waste collectors and companies
GreenLight Planet/SunKing (Symbiotics)	Symbiotics Group, a market access platform for impact investing, announces a \$15 million green bond transaction for Greenlight Planet
GrowSari	GrowSari raises \$30 million in Series B for B2B app that enables kiosks in the Philippines to access discounted goods from FMCG multinationals
Hello Tractor	HelloTractor receives \$4.5 million in philanthropic grants from Heifer, attracting private equity investment from John Deere
Husk (Klarna)	Klarna allows consumers to donate to carbon and nature-based climate solutions
IMFact	IMFact provides receivable financing to MSMEs in Kenya
ixo Foundation	ixo Foundation's "internet of impact" leverages blockchain and IoT to develop verification-based payment triggers
Jaza Duka	Jaza Duka uses credit scoring with Unilever and Mastercard to unlock SME finance in East Africa and Asia
Jia	Jia: Blockchain-based lending for SMEs
Kabadiwalla Connect	Kabadiwalla Connect uses technology to deploy loans to waste management aggregators
KOKO Networks	KOKO Networks taps into carbon finance to discount clean cooking fuel to low-income Kenyans
KoolBoks	KoolBoks uses IoT data to manage cold-chain operations in Nigeria and beyond for ag and health verticals
KopaGas	KopaGas IOT tech is acquired by Circle Gas for \$25 million, partners with Tek10 and AWS to expand IoT architecture

Implementing organisation	Use case identifier
Kopo Kopo	Kopo Kopo enables short term loans to off-grid energy providers based on digital lending assessment
Lendable	Lendable's Emerging Market Sustainability-Linked Loan Fund provides debt verified by asset tracking through proprietary digital platform API
LooWatt	LooWatt Madagascar's evolving partnership with the Antananarivo city authority
M-Akiba Digital Bond	Digital Bond issued by Kenyan government accessible by dumbphone
M-Kopa	MKOPA uses debt financing to finance devices and assets through PAYGO receivables and financing facility
Metro Africa Xpress Inc (Max.ng)	Nigerian mobility startup MAX.ng has secured NGN400 million (US\$1 million) in capital under a first-of-its-kind securitisation of vehicle lease receivables
mGreen	mGreen offers waste classification, collection, treatment, and transportation through a multi-level management system in Vietnam
Mirova SunFunder	'Carbon Credit Aggregator Platform', by Mirova SunFunder: aggregating the climate credit potential of small renewable energy product distributors
MNT-Halant	MNT-Halant issues bond to finance microlending through digital ecosystem in Egypt
Moove	Moove's vehicle financing solution for ride-hailing leverages embedded financing and revenue sharing
mPower	MPower uses Seedrs equity crowdfunding platform to fund expansion
Mr. Green Africa	Mr. Green Africa uses digital tools to increase efficiency of plastic waste operations in Kenya
Musoni	Musoni digitises microfinance services
Nithio	Nithio derisks receivables lending for small solar distributors in Africa through blended finance and artificial intelligence
Odyssey (Nigerian Electrification Plan)	Odyssey Results-Based Financing Platform for Energy in Nigeria
OneWattSolar	Islamic Finance to OneWattSolar
P-RECS (Odyssey)	P-RECs for Nuru and Odyssey offer renewable energy credits with Peace co-benefit monetisation
PayJoy	PayJoy raises \$30 million to expand smartphone financing in Asia, Africa, and Latin America
Powerblocks	Powerblocks, a platform to accelerate clean energy access in emerging markets', by Incharge Energy, installs BitCoin mining assets on oversized mini-grids
Samasta	Samasta Microfinance partners with AI powered collections provider Credgenics to expand loan book in India
SIMA/Angaza	The SIMA / Angaza Distributor Finance Fund (DFF) is a data driven initiative aiming to unlock debt capital for clean energy distributors in developing markets

Implementing organisation	Use case identifier
Sistema Bio	Sistema Bio sells carbon credits generated from their biodigester operations in India, Kenya, and Mexico
Solaris OffGrid (PayGOps)	'A platform for scaling up off-balance sheet receivables financing for off-grid solar' by Solaris Offgrid:
Sun Exchange	Distributed ledger technology-based fundraising channels: Powerhive and Sun Exchange (Kenya)
Sun King (Citi)	Sun King and Citi close first \$130 million sustainable securitisation to broaden access to finance for off-grid solar in Kenya
SunCulture	SunCulture monetises carbon credits through asset tracking of water pumps
Sylvera	Sylvera uses Satellites and Lidar for Carbon Sequestration Verification
ThriveAgric	ThriveAgric provides input finance to farmers thanks to digital platform for tracking performance and analysing credit
TradeBuza	TradeBuza provides input financing to farmers leveraging digital credit assessment technology
Triggerise	'In their hands' project, the world's first Development Impact Bond with a focus on adolescent sexual and reproductive health by Triggerise
Tugende	Tugende uses asset finance, technology, and a customer support model to help micro, small, and medium-sized enterprises own income-generating assets in Uganda
Unconventional Capital	Unconventional Capital uses automated data-driven processes for revenue-share lending to entrepreneurs in SSA
Untapped	Untapped pioneers revenue financing model for African startups leveraging IoT tracking on income-generating assets
Uptime	Delivering global rural water services through results-based contracts by Uptime
VECA	VECA aims to improve plastic waste management in Vietnam through sorting, collecting, transporting, and treating recyclable plastic with the help of licensed recyclers and collectors
Virridy	Virridy taps into climate finance to expand its sensor catalogue
Watu	Watu, an asset financing FinTech providing flexible financing solutions for income-generating assets, including motorcycles, has extended its receivables financing debt facility with AHL Venture Partners ("AHL") to a total funding amount of \$5 million.
Winock Solar (Charm Impact)	Charm Impact uses crowdfunding to lend to solar entrepreneurs
WOCAN/W+ (Pula)	Wocan/W+ develops co-benefits for women empowerment
Yellow	Yellow finances solar energy and digital devices powered by a digital platform offering credit analysis
ZOLA (NeOT)	NEoT Offgrid Africa launched a receivables securitisation programme to finance renewable energy projects in Africa with Zola Electricity Côte d'Ivoire (ZECI)

Selected trends and possible implications

Trends	Possible implications
Credit and lending wallets become more prevalent as smartphone penetration eventually overtakes feature phone ownership in emerging markets.	Alternative personal data, like psychometrics and digital identity verification based on biometrics like voice, facial, or thumbprint recognition, increase credit-lending opportunities for asset-focused utility service providers, particularly for the agritech space, farming, and SME supply chain finance gap.
Receivables financing will progressively extend from PAYG solar, first to eCooking and e-Mobility, then towards other PUEs like solar water pumps.	Real-time or near-real-time monitoring of such devices and their associated revenue streams, coupled with advanced analytics, will result in better visibility of portfolio health, offering greater creativity and flexibility in packaging receivables into different investable securities.
Crowdfunding mechanisms become an integral part of utility service providers' capitalisation journey, complementing angel, friends and family, and seed equity rounds.	Blockchain-based smart contracts increase the traceability and flexibility of stock ownership in companies. Diaspora funding may play a greater role in crowdfunding activities for social enterprises offering utility services as an untapped source of capital for social infrastructure, particularly in Africa.
Smartphone penetration supports embedded finance, enabling further revenue share and end-user financing schemes.	Smartphone adoption is expected to trigger a significant increase in end-user financing for auto-entrepreneurs and SMEs. The number of investable projects will likely grow as platforms providing loan access become more popular.
Satellite data becomes more precise and accessible, with utility service use cases driven by climate finance and agriculture credit lending.	Geospatial data and satellite imagery can help assess and monitor infrastructure like energy grids, water distribution networks or sanitation facilities, which can aid in identifying potential vulnerabilities and risks, as well as unlock opportunities for climate finance and alternative credit.
Results-based finance reaches a significant turning point, particularly in verticals where performance metrics have been tested.	General convergence on metrics and standards across countries and geographies yield a tipping point in replicability for monitoring methodologies as market players land on the right data points, collection methods, and verification methodologies for automating disbursement for utility implementers.
Credit/risk analytics incorporate ever more device data leveraging decreasing costs of IoT hardware across sectors.	Data analytics and machine learning algorithms enable the analysis of vast amounts of data to identify patterns, trends and potential risks. The application of these technologies holds the potential to support financiers in making more informed decisions regarding credit risk and resource allocation.
Co-benefits monetisation increases with digital identity solutions.	Automated chatbots and other device-based biometric digital identity mechanisms will facilitate the capture of qualitative indicators of beneficiary impact from nature-based and social environment projects.
Digital tokens and cryptocurrencies emerge from the hype-bust bubble through the growth of Central Bank Digital Currencies.	Government-backed cryptocurrencies will enable diaspora to participate in increasingly digitised bill pay services for utilities. The digitisation and traceability of such funds enables municipalities to participate more actively in digitally enabled innovative finance mechanisms to invest in operations, customer outreach, and effective subsidy management.
Collaborative platforms that enable data sharing and communication can provide a more holistic view of risks and opportunities.	Applications like WhatsApp are being leveraged more widely to provide additional information to customers, such as weather forecasts and crop prices, enriching their relationship with end-users. This enables farmers to maximise the benefits of assets like mini-grids or solar water pumps.

Annotated bibliography

University of Zurich (2021). [“Blended Finance: When to use which instrument?”](#) Blended finance has moved from the sidelines of financing instruments toward centre stage, with the sector witnessing rapid growth in diverse and innovative tools and practices. This analysis from the University of Zurich grouped 10 blended finance instruments into four clusters based on those that blend within a transaction and those that blend over time. Key sectors such as energy and conservation have demonstrated high usage and impact of such instruments, while water and sanitation lag behind. The study, based on 33 selected transactions, including 33 interviews and 12 case studies, provides guidance on which instruments to use when, and notes that decisions about which instruments to use in transactions often do not sufficiently involve beneficiaries and entrepreneurs.

Acumen (2022). [“Investing as a Means: 20 Years of Patient Capital”](#) In the two decades since its establishment, Acumen has pioneered the use of investment as a powerful tool to address poverty-related challenges. Their approach, known as ‘Patient Capital’, prioritises impact over financial returns, emphasising longer time horizons, greater risk tolerance, and innovative structures. With a focus on leveraging both philanthropic and commercial funding, Acumen has achieved significant milestones, including a benchmark financial return of 0.91x on their investments, nearly a billion dollars in follow-on funding, and direct impacts on the lives of over 380 million individuals. The report highlights the varying levels of success across different sectors, with off-grid energy services showing promise while sustainable healthcare delivery models face persistent challenges. Additionally, it highlights the concerning statistic that only 9% of impact assets in emerging markets have been invested in crucial areas such as water and

sanitation, education, housing, and healthcare combined. The authors conclude that evolving approaches and support mechanisms are necessary to foster the growth of organisations dedicated to delivering impactful solutions to marginalised communities, emphasising a balance between financial and impact returns across the funding landscape.

World Bank (2022). [“Digital Monitoring, Reporting, and Verification Systems and Their Application in Future Carbon Markets”](#) One of the main criticisms of the carbon credit generation governed by independent standards—whether for compliance purposes under the CDM or voluntary markets, as with the Gold Standard and VCS—is the time and cost of monitoring and verifying projects. This World Bank report discusses the technologies that can address these challenges, principally focusing on the potential of AI, smart meters, remote sensors, satellite and drone imagery. It includes six case studies from around the world where such digital technologies have been applied, including a 9.4MWp Clean Development Mechanism programme subsidising grid-connected rooftop solar in India, as well as a digital platform tracking over a million grid connections and mobile-based energy payments for generating certified emissions reductions in Uganda.

AVCA (2023). [“Climate Financing in Africa: Strategies for the Future”](#) The AVCA 2023 Climate Financing in Africa report provides an overview of climate funding trends in the region. Between 2012-2022, the report authors document 822 climate-related investments with a total value of \$17.4 billion, the lion’s share of which is in the clean energy and utilities space in East Africa, enabled by PAYGO technology. Venture capital share in climate finance is anticipated to grow from an annual average of 56% over the last decade to more than two-thirds going

forward. The report also documents the gradual emergence of over 50 green bonds issued on the continent from a range of sovereign, supranational and commercial actors.

ESMAP (2020). [“Funding the Sun”](#) This 2020 landmark report from the World Bank’s ESMAP unit offers a deep dive into different financing instruments currently and potentially available for off-grid energy service providers. The report covers 17 finance instruments across five categories: grant, debt, equity, catalytic (including first-loss facilities, finance matching mechanisms, pooling facilities, and foreign exchange hedges), and distributed-ledger/cryptocurrency-based models. The maturity of innovative finance mechanisms covered in the report is indicatively highest for debt instruments, both in number of instruments and volumes dispersed. Dozens of case examples are offered principally from Africa, Europe, and to a lesser extent Asia and Latin America.

Clean Cooking Alliance/ESMAP (2022). [“Clean Cooking RBFs Key Design Principles”](#) This 2022 report provides insights and learnings from 12 case studies in results-based financing initiatives for promoting clean cooking solutions (including improved cookstoves biomass solutions, pellets, gasifiers, ethanol, charcoal, LPG and eCookers). Almost all programme disbursements were tied to unit sales, and financed through sales of various carbon markets and/or health impact metrics. Verification for all programmes were performed manually through paper trail audits, phone calls and field visits. Digital verification is noted as a key solution to improving disbursement timelines, though the additional costs engendered by such monitoring is highlighted as an obstacle.

GSMA (2023). [“IoT and Essential Utility Services: Opportunities in low- and middle income countries”](#)

This landmark GSMA report on IoT applications for energy, water, waste, sanitation and transport in emerging markets evaluates 17 common use cases across five markets—Indonesia, India, Kenya, Nepal, and Nigeria—uncovering trends applicable to low- and middle-income countries. Energy is noted as the most advanced sector in IoT applications, with a significant number of smart meters deployed and plans for future expansions driven by off-grid energy services such as maturing microgrids and PAYG models. Smart metering in the water sector has seen slower adoption, though it plays a key role in improving revenue collection, service quality, and monitoring harmful discharges. In the nascent stages of the sanitation and waste management sectors, IoT, combined with digital platforms and blockchain, is aiding in traceability across value chains, while asset tracking for transport emerges in nearly all case study markets.

Dalberg (2014). **“Innovative Financing for Development: Scalable Business Models that Produce Economic, Social, and Environmental Outcomes”** This landmark report identified 14 categories of innovative finance instruments and quantified their total amount mobilised at \$94 billion between 2000 and 2013. Securities and derivatives constituted more than 80% of this value, of which a single instrument—the World Bank’s MIGA guarantee mechanism—represented 26%. Thematic bonds (25%) were the next largest mechanism, followed by results-based financing (5%, growing 80% annually on average.) The report projects the 2015-2030 period to be dominated by the growth of outcomes-based financing in attracting private capital, on the assumption that performance data emerges to establish mature asset classes.

The Lancet (2017). **“Innovative financing instruments for global health 2002-15: a systematic analysis”** This peer-reviewed article examines innovative financing instruments specific to the global health

challenge, mapping 10 selected instruments across the value chain of resource mobilisation, pooling, channelling, resource allocation, and implementation. The 10 instruments accounted for 2-3% of overall development assistance in health for a total of \$8-9 billion between 2002-2015, and were principally used for programmes for new and underused vaccines, HIV/AIDS, malaria, tuberculosis, and maternal and child health. Use of these innovative financing instruments were driven by private philanthropies (Gavi, Global Fund), multilaterals and bilaterals (IFC, JICA) as well as voluntary and compulsory private sector sources (ProductRED and Airline Levy).

African Journal of Management (2021). **“Digital innovations for transitioning to circular plastic value chains in Africa”** This peer-reviewed article reviews the usage of digital technologies for startups addressing the plastic recycling challenge in Africa. It analyses the available literature on recycling on the continent (identifying 42 recycling plants on the continent, the majority in South Africa, Nigeria, and Egypt), and offers a deep dive into three cases from Nigeria (WeCyclers), Uganda (Yo-Waste) and Zambia (Recyclebot), describing the digital technologies used, volumes collected, and principal challenges. The three organisations considered are primarily grant-funded, and principally offer a multi-sided platform model that matches aggregators, buyers, and sellers for recyclable materials through GPS and reward incentives.

Stanford Social Innovation Review (2017). **“The Next Phase of Innovative Financing”** This report from 2017 reflects on the early evolution of innovative financing, focusing on a public-private partnership between ICRC to fund health centres in three African countries with a consortium of European government funders based on a pay-for-success model. The piece pinpoints the origin of the term impact investing to around 2007 and the first social impact bond in 2010, and highlights

the ‘time value of money’ that innovative financiers can unlock by borrowing against governments’ large upfront commitments, the increasing convergence between ‘traditional’ and ‘sustainable’ investment, and the importance of digital tools and data in enabling investors to ‘price’ social impact.

OECD (2020). **“Alternative Financing Instruments for ASEAN SMEs”** This publication provides Southeast Asian policymakers with strategies to enhance SME and entrepreneur access to diverse financial instruments, including digital innovations like blockchain-based financing and fintech-enabled financing like P2P lending and equity crowdfunding. The authors note that the growth of digital finance platforms such as crowdfunding and blockchain technologies has shown promising trends in select geographies where the regulatory environment enables them, such as in Indonesia, Singapore, and Thailand. Trade finance is identified as a particularly ripe area for digitalisation for SMEs seeking to tap into global value chains. The authors conclude that for SMEs in the ASEAN region, the key to harnessing these digital financing methods includes creating a regulatory environment that supports innovation, improving credit information infrastructure, fostering a healthy digital ecosystem, and enhancing financial literacy.

UNDP (2022). **“Linking Global Finance to Small-Scale Clean Energy”** This report analyses potential links between global finance to small-scale clean energy projects in developing countries through the lens of opportunities in financial aggregation vehicles and instruments. The analysis identifies key barriers, market enablers, case studies, insights and recommendations that can unlock greater capital flows for developers and markets beyond those already capturing the majority of investment, represented by less than a dozen companies in East Africa. Digital platforms are explored as a key enabler of project and finance

aggregation through reducing costs and enabling standardised KPIs. The report serves as part of the UNDP’s ongoing Climate Aggregation Platform project, which aims to provide market support for the deployment of additional climate solutions towards energy access solutions.

Sustainable Digital Finance Alliance (2022). **“Sustainable Digital Finance in Asia: Creating Environmental Impact through Bank Transformation”** This report by DBS and the Sustainable Digital Finance Alliance explores how the integration of digital technology with finance can create environmental impact. It provides a deep dive into how digital technologies such as AI, blockchain, mobile technology, IoT, and cloud can be harnessed to facilitate sustainable finance, defined as the use of various technological platforms, including mobile payments, crowdfunding, P2P lending, big data, AI, blockchain, digital tokens, and IoT, to support the Sustainable Development Goals (SDGs). The report outlines a three-step process towards green transformation: capturing sustainability metrics, integrating these into existing financial services, and developing new sustainable products. It focuses on three general applications of technology that can facilitate this transition: Sensing (Earth observation technologies and IoT, including RFID chips and geospatial AI that allow the monitoring of sustainable investments or unsustainable activities), Structuring (using blockchain to record data and transactions in real time, which offers transparency, and analysing big data can improve sustainability integration) and Sculpting (utilising new data and structures to create value-exchange networks and new marketplaces.). Several case studies illustrate the practical applications of these concepts, including Ant Forest’s carbon wallet, DiMuto’s blockchain-based trade system, the World Bank’s blockchain bond BOND-I, and Arbol’s blockchain-based index insurance market.

BIS / World Bank (2020). **“Payment**

aspects of financial inclusion in the fintech era” This report by the Committee on Payment and Settlement Systems (CPMI) and the World Bank provides guidance on recent fintech developments that have relevant implications for financial inclusion and payments specifically. It covers trends in eight new technologies (application programming interfaces, big data analytics, biometric technologies, cloud computing, contactless technologies, digital identification, distributed ledger technology, IoT), three ‘products and services’ (instant payments, Central Bank Digital Currencies, stablecoins) and three ‘access modes’ (electronic wallets, open banking, and super apps.)

ILO (2018). **“Innovative Finance: Putting your money to (decent) work”** This report by the International Labour Organization reviews trends in innovative financing and takes a position on which instruments might be appropriate for advancing the agenda of decent work for all. It considers four categories of private-sector oriented instruments (financial products, risk mitigation products, results-based finance and technology solutions) as well as three country-level ones (taxes and obligatory charges, voluntary solidarity contributions and debt management.) Appendix 2 provides detailed descriptions of each instrument with examples.

UNCTAD (2023). **“Ensuring Safe Water and Sanitation for All A Solution through Science, Technology and Innovation”** This report by the UN Conference on Trade and Development explores the role of science, technology, and innovation as key enablers of catalytic actions toward achieving universal access to safe water and sanitation. A chapter on frontier technologies for improving access to these services highlights cases leveraging drone technology, AI, big data, IoT, satellite imagery and digital twinning from around the developing world. The authors advocate for blended finance models at the macro-level combined with micro-financing for small scale oper-

ators, leveraging innovative finance solutions like PAYGO and tapping into sustainable and green finance for improving the financials of achieving WASH targets. They caution, however, that given the uniquely transdisciplinary nature of WASH challenges, financial viability may be impossible without considering targets within larger nexus paradigms like circular economy or the Food-Water-Energy Nexus.

WRI (2022). **“Unlocking Early-Stage Financing for SDG Partnerships”** This report by WRI explores the knowledge gaps in how impact capital attracts follow-on commercial finance in practice. It highlights the need for innovative finance (in particular, blended finance) for organisations mired in the ‘missing middle’—the transitory period in which they have outgrown grant funding but are considered too early for commercial investment. The authors argue that clear articulation of impact is core to the challenge, as donors and investors have yet to converge on standardised impact management systems, resulting in lowered investment risk tolerance. Six case studies of successful partnership approaches raising over \$5 million in post-grant private finance are discussed, highlighting the need for multiple, flexible and long-term ‘anchor’ funders for scaling SDG partnerships.

GEF (2023). **“Innovative Finance for Nature and People: Opportunities and Challenges for Biodiversity-Positive Carbon Credits and Nature Certificates”** This report presents the state-of-play, diagnostics and recommendations for unlocking new financial resources for the conservation, sustainable use and restoration of biodiversity in a socially inclusive manner, with a focus on two emerging instruments—biodiversity-positive carbon credits and nature certificates. The report charts the emergence of compliance (\$260 billion annual value) and voluntary (\$2 billion annual value but growing rapidly) carbon markets and their relationship to nature-based solution and

biodiversity financing. Several 'debt-for-nature' sovereign debt-swaps are discussed, as well as technologies that can improve the transparency of markets, including satellite imagery, bioacoustics, drones and digital ledger technologies.

UNCTAD (2023). ["Technology and Innovation Report: Opening green windows Technological opportunities for a low-carbon world"](#) This report provides a comprehensive and timely picture of green and frontier technologies, including trade data-backed analysis of their market size, potential for employment creation, and most promising sectors. The report focuses on 10 frontier technologies (AI, IoT, big data, blockchain, 5G, 3D printing, robotics, drones, gene editing and nanotechnology) and seven green technologies (solar PV, concentrated solar power, biofuels, biomass and biogas, wind energy, green hydrogen and electric vehicles). UNCTAD estimates that these technologies represent a \$1.5 trillion market in 2020. Thanks to their rapid growth, by 2030 their market value could reach over \$9.5 trillion—about three times the current size of the Indian economy.

GSMA (2021). ["Investment Trends in the Indo-Pacific Region"](#) This report provides an overview of the investment landscape across the Indo-Pacific region, based on analysis of over 1,300 deals across fast-growing ecosystems such as Singapore, Indonesia, Malaysia, and Vietnam, to the nascent sprouts of entrepreneurship in the small Pacific Islands, Laos, and Myanmar, which are yet to enjoy the same volume and type of resources. The authors note the region has witnessed the fast rise of unicorns (i.e., companies valued over \$1 billion) and tech giants, with over a dozen nine-figure rounds raised by startups over the past half-decade, and describes how solutions for online banking, payments and savings have complemented the rise of the digitised logistics and delivery space, as well as the growth and investment dominance of super-apps like Grab, Go-

Jek, Tokopedia, Bukalapak, Traveloka, and SEA Group.

WEF/pwc (2020). ["Unlocking Technology for the Global Goals"](#) This report takes a future-looking perspective towards which fourth industrial technologies can support the UN's Sustainable Development Goals. The analysis finds that such frontier technologies are likely to have a high impact on 10 of the 17 goals, as well as more than 70% of targets. Big data platforms are estimated to support 100% of the goals, while other technologies with the most wide-ranging impact include AI (50%), IoT (33%), blockchain (25%), and advanced materials (10%). The report maps 'innovation combinations' (such as sensors + robotics + AI + 5G = autonomous vehicles) against each SDG, and ranks their maturity based on factors like existing deployment and potential to scale. The report also includes sections on innovative finance, emphasising the role of blended finance for early-stage technology commercialisation and the role of government-led initiatives in targeting market failures and public goods.

Sustainable Digital Finance Alliance (2018). ["Digital Technologies for Mobilizing Sustainable Finance Applications of Digital Technologies to Sustainable Finance"](#) This report, focusing on the intersection of digital finance and sustainable finance, features dozens of successful use cases from G20 nations that employ innovative technologies to unlock finance. The technologies principally employed include big data/machine learning/AI, blockchain, satellite imaging, and IoT. Comprehensive definitions are offered for digital finance and sustainable finance. The authors map use cases across SDGs and offer a pyramid framework for conceptualising the intersection of finance and social impact.

Water Alternatives (2021). ["Digital innovations and water services in cities of the global South: A systematic literature review"](#) This systematic review analyses digital water technologies in the Global South,

where it is predicted that by 2025, half of utilities will have water systems incorporating such technologies. The authors find that research in the field, focused mostly on Africa and Asia, has been largely fragmented and focused on technical, positivist/realist, and quantitative analysis, limiting the accumulation of diverse, interdisciplinary knowledge from the social sciences. On the technology front, the majority of the studies reviewed dealt with data processing/visualisation and action support technologies rather than data capture and decision-support technologies. The authors find the field has been slow to explore potentially transformative technologies, such as AI, blockchain, or machine learning, which have been more extensively used in the Global North.

Uptime (2021). ["Delivering Global Rural Water Services through Results-Based Contracts How a standard contract design with payment for results can ensure resilient water services at scale"](#) This working paper by the Uptime Catalyst Facility presents the results of their pioneering results-based finance approach in rural water service sectors across seven countries, disbursing \$207,836 in Q4 of 2020 and reaching approximately 1.5 million rural residents in seven countries. The report discusses the ongoing development of a 'revenue-matching' contract design, usage of digital payments, and digital verification methods for monitoring the performance of water maintenance providers. The report considers trade-offs in costs and complexity around real-time monitoring, and partnerships with organisations like REACH and the Rural Water Supply Network to scale operations while enhancing incentives for service providers and ensuring service reliability.

GSMA Head Office

1 Angel Lane,
London, EC4R 3AB, UK
Tel: +44 (0)207 356 0600
Email: info@gsma.com

