

CONNECTING FINANCE TO RESULTS:

CAN EMERGING
TECHNOLOGIES
MAKE IMPACT
BONDS MORE
IMPACTFUL?

MARCH 2019



FRONTIER TECHNOLOGY CONNECTING FINANCE TO RESULTS TO PAYMENT

Research Study Report

March 2019

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EXECUTIVE SUMMARY

Impact Bonds are a potentially transformative new mechanism in the development toolkit, but the costs and complexities in designing, structuring, contracting, verifying and evaluating these instruments are still being addressed. This report analyses the existing landscape of emerging technologies deployed in use cases relevant to results-based financing structures, including Remote Imagery, Distributed Ledger Technologies, Artificial Intelligence, and the Internet of Things¹ to assess whether these technologies can play a role in making Impact Bonds more robust, cost-effective, efficient and transparent.

Despite the absence of much substantiating evidence, the research analysis indicates that there appears to be great promise in many existing use cases. The main constraint to the scale of these technologies seems to be the absence of an enabling ecosystem within which individual use cases can thrive and scale. Enabling ecosystem deficits include efficient interoperability between the many different tokens, cryptocurrencies and platforms; capacity of donors and governments to understand and use the technologies; and availability of cheap, cost-effective, robust technological infrastructure.

This report offers insights based on analysis of five of the more mature applications and makes recommendations for how DFID could most constructively develop and shape the field:

1. Supporting the pathway to self-reliance in countries that are ready for or are considering the use of outcomes-based contracting
2. Encouraging the development of standards to facilitate interoperability
3. Applying emerging technologies to DFID Impact Bond programmes whenever possible
4. Providing opportunities for blended finance vehicles to engage in the development and scaling of the ecosystem
5. Committing to openly sharing lessons and encouraging other actors to do so as a matter of course.

1. A Glossary of Terms is provided in Annex 1.

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ACRONYMS

AI	Artificial Intelligence	MIT	Massachusetts Institute of Technology
CEO	Chief Executive Officer	ML	Machine learning
DApp	Decentralised application	MRV	Monitoring, reporting and verification
DFI	Development Finance Institution	NDA	Non-disclosure agreement
DFID	Department for International Development	NGO	Non-governmental organisation
DIB	Development Impact Bond	ODA	Official Development Assistance
DLT	Distributed ledger technology	OECD	Organisation for Economic Cooperation and Development
EPFL	École polytechnique fédérale de Lausanne	PBR	Payments-by-results
FTL	Frontier Technology Livestreaming	RBF	Results-based finance
GIIN	Global Impact Investing Network	RS	Remote sensing
GRI	Global Reporting Initiative	SDGs	Sustainable Development Goals
HQ	Headquarters	STOs	Security Token Offerings
HRMC	Her Majesty's Revenue and Customs	UK	United Kingdom
IBMAP	Impact Bond Market Acceleration Partnership	UN	United Nations
ICO	Initial Coin Offering	UNICEF	United Nations' Children's Fund
ICT	Information Communication Technology	US	United States
IDS	Institute of Development Studies	UTrs	Universal Trackers
IP	Intellectual property	VTC	Vocational Training Centres
IOT	Internet of Things	W3C Protocol	World Wide Web Consortium Protocol
IRIS	Impact Reporting and Investment Standards	WFP	World Food Programme
J-PAL	Abdul Latif Jameel Poverty Action Lab	WWG	World Wide Generation
KPIs	Key performance indicators		

INTRODUCTION

The Sustainable Development Goals (SDGs) are recognised as being both the globally unifying framework for understanding development impact and extremely ambitious targets for a global 2030 agenda. The increased integration of technology in development is likely to be critical to achieving the SDGs, and as such, disruptive technologies are being taken up and piloted by a range of development actors. These technologies include Remote Sensing (RS), Distributed Ledger Technology (DLT), Artificial Intelligence (AI) and Machine learning (ML) and the Internet of Things (IOT).

Stratigos was commissioned by the Department for International Development (DFID) through the Frontier Technology Livestreaming (FTL) initiative² to conduct **a scoping study of the application of frontier technologies to increase transparency, trust and efficiency in the results delivered – and how enhancing these factors can be used to both trigger payments as well as bringing new forms of financing to bear**. The study examines the extent to which these technologies have a near-term role to play in more effectively financing development interventions – specifically examining how the Impact Bond ‘finance to results to payment’ cycle can be enhanced through emerging technologies.

Performance-based contracting is standard in United States (US) Federal Contracts and has been for several decades now. The non-profit sector, and indeed many major foundations in the development space, have been moving toward performance-based contracts, and the last ten years saw this evolve into basing payments not on inputs, but on results – broadly known as results-based financing (RBF), or payment-by-results (PBR).

Alternative investing structures at the convergence of public private partnerships, impact investment and results-based financing known broadly as impact bonds developed from these contracts to address financing gaps. As the purpose of the study was to provide DFID with a landscape of a very specific segment of the emerging technology space, this report serves to highlight initiatives using some of these technologies to facilitate PBR – it does not address the myriad of other areas where these and other technologies could improve or transform the delivery of development initiatives.

We have broken up the finance-results-payment cycle using a structure modified from the Brookings Institution report *Using Impact Bonds to Achieve Early Childhood Development Outcomes in Low- and Middle-Income Countries*³.

A PBR contract puts the onus on the service provider to achieve the **results** prior to receiving **payment**. In an impact bond structure, the initial **finance** comes from investors. This investment capital is used by the service providers to resource the activities needed to achieve the **results**. If the achievement of the agreed result targets are verified, the outcome funder makes a **payment**.

Diagram 1 describes both the PBR cycle as well as the finance to results to payment cycle used for impact bonds.

² Implemented by IMC Worldwide.

³ Gustafsson-Wright, E. and Gardiner, S. January 2016. Brookings Institution

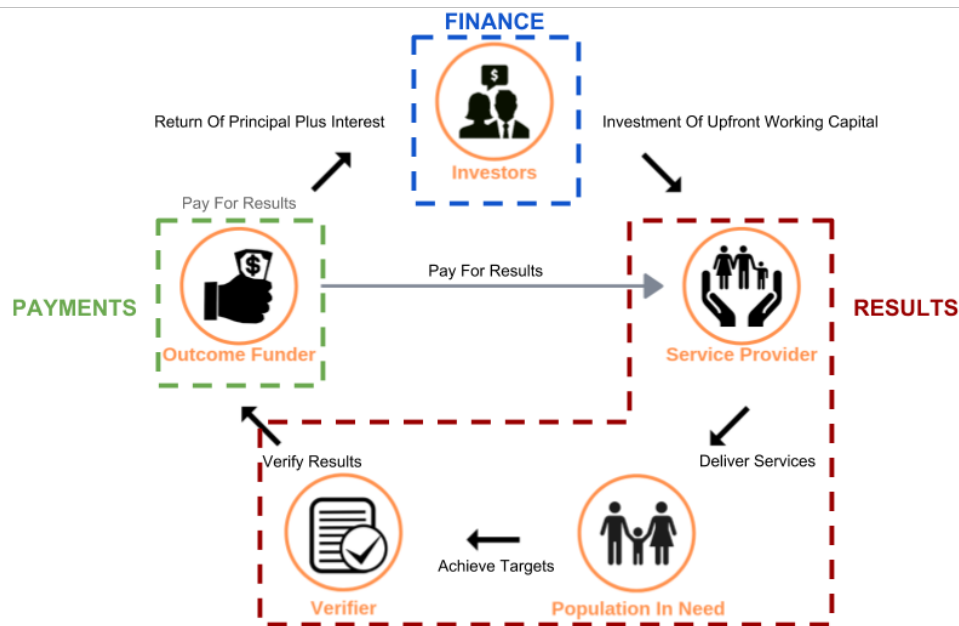


DIAGRAM 1 The Finance-Results-Payment Cycle

As these technologies are relatively new (many use cases only commenced in 2017), there are no significantly scaled success stories using these disruptive technologies. The report features five of the most promising and practical solutions identified through sector expert consultations and research and provides a review of example use cases and pilots in Annex 3.

Many of the examples – and all the applications investigated in detail – use DLTs as a central component of their applications. The most well-known form of DLT is the blockchain, which creates secure, decentralized and time-stamped ledgers that record transactions in a peer-to-peer network. Although the blockchain as we know it was initially developed to build the cryptocurrency ecosystem (specifically Bitcoin), other uses such as tracking the flow of goods and verifying the identity of citizens highlight its potential to improve accountability in other fields. In the humanitarian and development space, a diverse cross-section of organisations are experimenting with the blockchain to distribute and monitor aid funding, to create digital identities, to secure land registries, to facilitate access to finance – and to connect financing to results and to payments.

THE PROMISE OF FRONTIER TECHNOLOGIES

Impact Bonds are costly and time consuming to design, structure, contract, verify and evaluate, but it has already been demonstrated⁴ that they:

- Focus interventions on outcomes
- Drive performance management
- Incentivise collaboration
- Build a culture of monitoring and evaluation
- Drive investment in preventative measures
- Reduce risk for governments

What is not evident that they live up to the other early hopes⁵ for Impact Bonds:

- Crowding in private funding
- Achieving scale
- Supporting experimental interventions
- Sustaining impact

The emerging technologies examined in this study demonstrate promise in each of these areas (Diagram 2), but again there is little substantive evidence to back these claims, and many well-informed experts in their own fields who question them⁶.

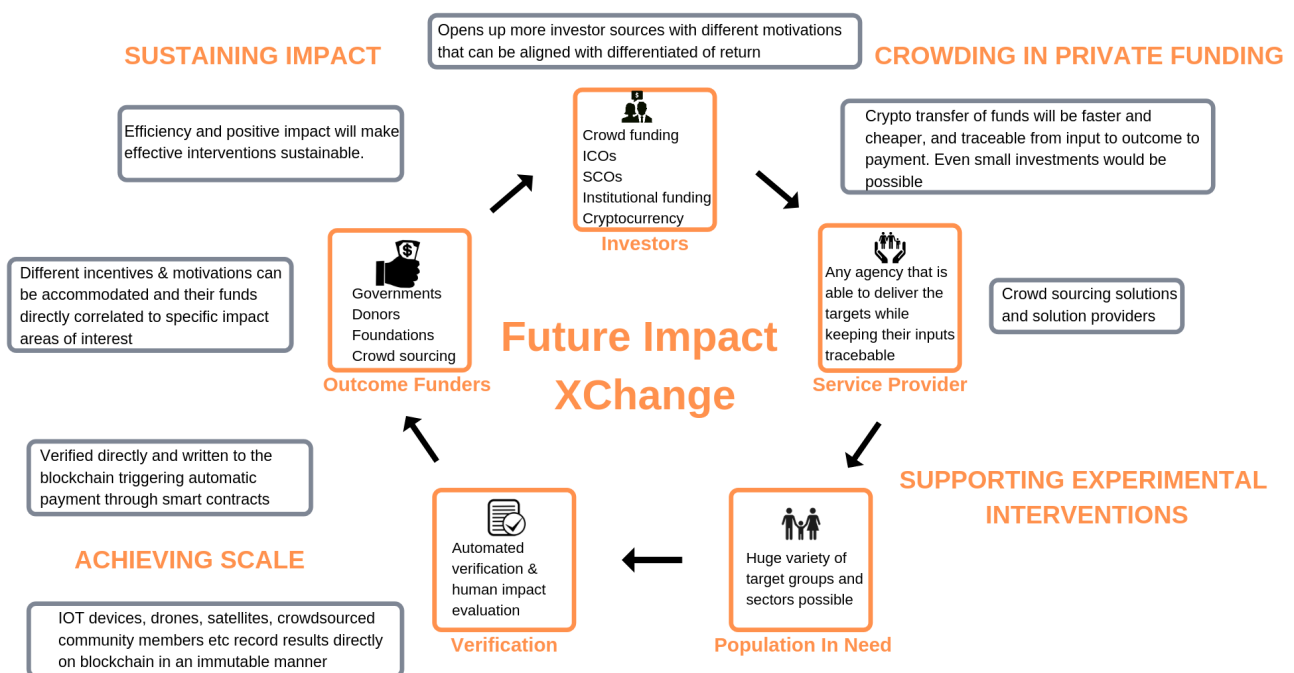


DIAGRAM 2 The Potential of Frontier Technologies in Future Impact Bonds

4 Gustafsson-Wright, E., Boggild-Jones, I., Segel, D., and Durland, J. Impact Bonds in Developing Countries – Early learnings from the Field. Centre for Universal Education at Brookings and Convergence. September 2017

5 Center for Global Development and Social Finance. (2013). Investing in social outcomes: Development impact bonds. The report of the Development Impact Bond Working Group.

6 eg Blockchain for International Development: Using a Learning Agenda to Address Knowledge Gaps by John Burg, Christine Murphy, and Jean-Paul Petraud <http://merltech.org/blockchain-for-international-development-using-a-learning-agenda-to-address-knowledge-gaps/>

Diagram 2 highlights where frontier technologies have significant potential to add value to the Finance-Results-Payment cycle; and one of the interesting elements to point out is how many of the most significant areas relate to the democratisation of impact bonds through crowdsourcing many of the elements. Small scale investors will be able to participate in a liquid market, ideas for solutions and target areas can be crowdsourced, communities can take part in the design process – and indeed be service providers as well, verification agents can be trusted members of the community, and those wishing to make donations but be sure of the impact of their donation will be able to contribute to outcomes funds. So while crowdsourcing is not a new technology, it does have the potential to be a significant element of impact bonds in the future, and it's worth considering how, for example, the work that the UNDP AltFinLab is doing with their Crowdfunding Academies (Annex 3) could be harnessed in the future.

METHODOLOGY

Given that most of these projects are early stage, the team used a snowball sampling approach to source use cases, interviewees and documentation. Successful use cases of these technologies in development were examined, with an emphasis on the variables that have been barriers to scale. 36 interviews with actors across the landscape were conducted (listed in Annex 2), in addition to drawing upon various types of literature (media, reports, blogs, etc.) to inform the study.

The report is qualitative in nature, incorporating a modified version of the Gartner Hype Cycle (the complete framework is provided in Annex 4) as a methodological framework to structure the analysis of the use cases. The hype cycle, a graphical presentation to represent the maturity, adoption, and social application of specific technologies, is published by Gartner annually.

After the research team's initial landscaping of use cases, it became clear that none of the reviewed use cases were close to scaling, so presenting them in terms of maturity and adoption was not useful.

As a result we modified the framework in two significant ways:

1. The y axis, which in the original model relates to hype, visibility or expectations, was changed to Rate of Uptake of the technologies.
2. Under this new framing, the peak of anticipation and trough of disillusionment were no longer useful concepts, and instead it was more descriptive to plot use cases against a different type of maturity: focussing on ecosystem development.

The phases of the Uptake Cycle, as illustrated in Diagram 3, are:

- **Innovation Trigger:** A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist.
- **Single Use Cases:** Early publicity produces several success stories — creating a variety of single use cases for the innovation and its potential. These are usually isolated to a single geography and addressing a single specific social challenge, but often with a blend of frontier technologies being incorporated into the use case.
- **Ecosystem Development:** As the ecosystem develops, more instances of use case benefits start to crystallise and become more widely understood. Interoperability, standards and best practice begin to be focussed on, as use cases focus on scale.
- **Mainstream Adoption:** Scaled solutions become the norm. Platforms are developed that interact with and are used by mainstream development initiatives and formal institutions.

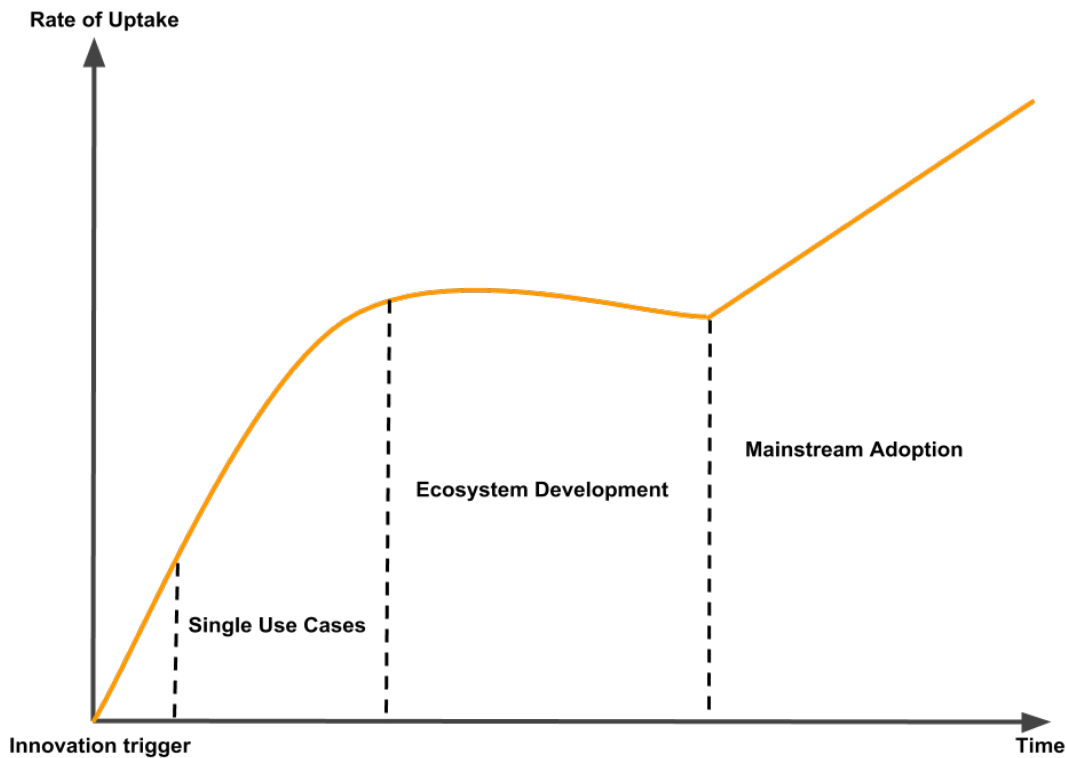


DIAGRAM 3 The Uptake Cycle

Through interviews and research, more than 30 use cases were reviewed, however many of these were informationally incomplete or without publicly distributable documentation. From this larger set, we selected a sample of 22 use cases with enough information to analyse using the framework.

During the initial interviews, the team identified a long-list of initiatives for more in-depth examination. Through discussions with the DFID and FTL teams during the presentation of initial findings, the team identified a shortlist of five applications to focus on. The five selected were chosen based on several criteria: stage of development, mix of technology uses, geographic focus, and extent to which the stated aim of their application was to complete the chain from finance to results to payment. As a result, the team conducted a comparative review of what was at the time perceived as the most promising – and practical – solutions; the applications developed by Proof of Impact, World Wide Generation (WWG), ixo, Sela and Alice⁷.

These deep-dives were informed by multiple in-depth, semi-structured interviews with the founders and key staff of the respective companies. The firms provided additional documentation on the progress of developing, funding, piloting and scaling their solutions. These interviews were also used to draw out the key barriers to scaling and identify the opportunities for funders to help address scaling challenges.

The team faced several constraints during the assignment, notably sparse documentation, little to no evaluation of the effectiveness of the applications in driving impact, and information disclosure (given the proprietary nature of technology). Another significant limitation is the swiftly evolving nature of the space, and the number of entrepreneurs crowding in. At least two other companies, Socioladder based in Dubai and Shanzhai City based in Hong Kong, have interesting and novel approaches to connecting the finance-results-payment cycle, and would have been worth exploring in deep-dives had they been identified earlier.

⁷ A small number of potentially promising initiatives that were approached to be included were not, due to an unwillingness to participate or disclose progress.

LANDSCAPE OF USE CASES

The report differentiates between single use cases and applications. Single use cases address individual challenges and tend to be more about piloting the feasibility of a specific technology in a specific situation. They are the precursor to applications, and as such it is essential to review them to critically assess the potential success of applications. Applications target scale from the onset, encompass several use cases and use a mix of frontier technologies across different parts of the finance-results-payment cycle⁸.

The initial literature review and the interviews conducted brought to light numerous examples of use cases featuring innovative approaches to applying technology to solve specific social and development challenges; there are 650 use cases just of blockchain-based positive impact initiatives listed on a single website⁹.

In applying the Uptake Cycle framework to the use cases, we assessed each of the 22 use cases (Annex 3) against progress on the financing-results-payment cycle – essentially analysing the potential of each use case to create a viable and fully transparent link between **financing** of activities, achievement of **results** (also looking at their capacity to verify results as part of their solution), and to trigger **payments**.

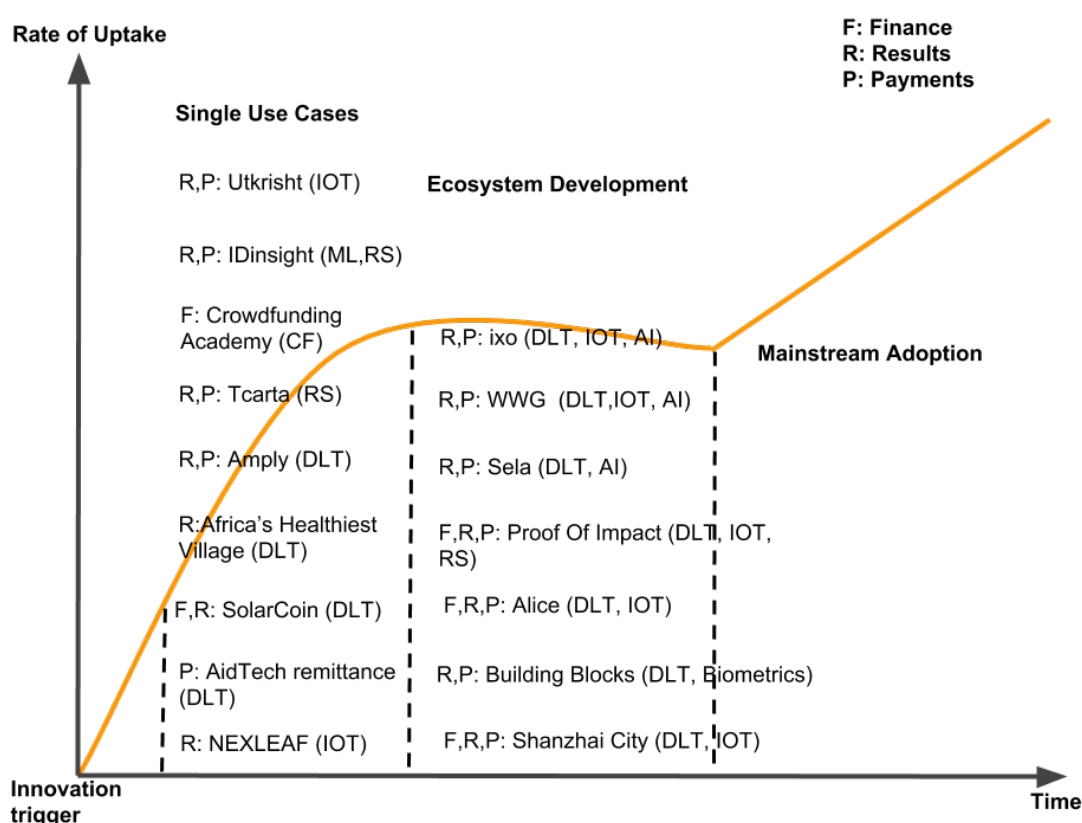


DIAGRAM 4 Landscape of Use Cases Integrating Frontier Technology for PBR

8 Applications are further defined in the Glossary of Key Terms.

9 positiveblockchain.io

The mapping exercise (Diagram 4) highlighted several key findings:

- 1) Most examples are 'single use cases', these use cases are primarily at the pilot stage, disparate, and nested in local geography (which limits scalability). Those at ecosystem development stage are typically, although not solely, the follow-ons to pilots or building on previous work.
- 2) Many use cases were assessing how AI and ML would integrate into their solution, and how the IoT would bring down the cost of human verification, but only the most ambitious or most developed were in the process of business integration of more than one of the frontier technologies of interest. Cost, absence of existing infrastructure, reliability concerns and focussing on the immediate challenge at hand were viewed as the main barriers for this.
- 3) It is not yet clear if there is a first mover advantage in the space. It is possible the newer projects will benefit from the ecosystem building efforts (e.g. regulatory environment, tech protocols, etc.), and the open source intellectual property (IP). While two of the platforms reviewed are building proprietary, permissioned blockchains, this is a little unusual and in some ways not in keeping with the ethos of many developers, who regard the lack of gatekeepers and intermediaries as one of the most important advantages of the blockchain. It is almost a point of honour that successful developers upload their code to GitHub, a site that allows the global community of developers to share and collaborate with one another to build better solutions.
- 4) The snowball sampling approach initially revealed both use cases and applications simultaneously. However, given the aggregating nature of the Uptake Cycle, it was less effective as a framework for analysing the applications. Therefore, the applications were reviewed using a case study or 'deep-dive' methodology focussed on the finance-results-payment framework and specific questions related to:
 - how long the applications have been in use,
 - the approach they are using to addressing scale constraints,
 - their area of operations,
 - the technologies used and the underlying blockchain platform,
 - current scale,
 - the likely timeline to full implementation of their vision,
 - funds raised, and
 - token name and value metrics.

Overall, the landscape mapping exercise revealed that there are and will continue to be numerous relevant use cases developed using these frontier technologies. These use cases are the building blocks upon which larger programs are established and against which applications are tested. Their diversity and creativity is impressive, ranging from using satellite imagery to measure the results of anti-deforestation initiatives; to harnessing the blockchain to drive transparency in the use of charity donations; to building AI engines using machine learning increase the efficiency of data collection; to consolidating several impact investment funds on the blockchain.

However, while these examples demonstrate that every component of the finance to results to payment chain is currently being addressed in individual use cases, none of them bring all the component pieces together in a format that has scaled. There are, however, a leading group of companies that have a clear vision of being able to bring these elements together soon.

We review five of these companies in depth; each of them approaching the pathway to scale in unique ways.

APPLICATIONS AND APPROACHES TO SCALE

For the purposes of this report, an application is regarded as a solution that is bringing some or all elements of private capital, donors, governments, service providers and communities together around activities whose results and attendant payments are measured, verified and transacted using the frontier technologies of interest. Using this definition less than a dozen applications were identified; the process for selecting the five applications for deeper analysis is depicted in Diagram 5.

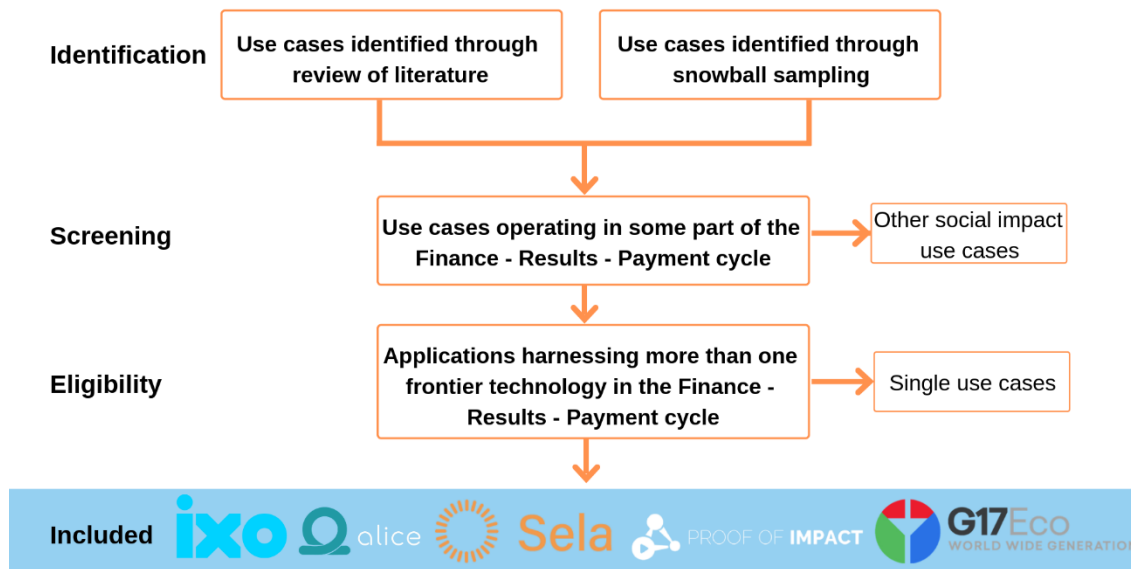


DIAGRAM 5 Selection Process for Deep Dive Applications

The five applications selected are each making concerted efforts at tackling the constraints imposed by a lack of interoperable ecosystem/s in unique ways. They are characterised as follows:

1. From the bottom-up - Sela;
2. Harnessing the Maker's Culture – Proof of Impact;
3. Ensuring regulatory compliance - Alice;
4. Aligning global technical protocols - ixo; and
5. Collaborating with disparate actors - WWG.

An analysis of these five approaches makes it clear that they are all seeking to address the primary barrier to scale for all of them: the lack of an ecosystem that enables large amounts of private capital to be harnessed to address urgent social challenges.


The unique way that each of the companies approaches this constraint probably reveals more about the background and motivation of the founders of the companies than anything else – the reality is probably that each approach is necessary, and that the most effective way forward will be to combine the best parts of each of them.

Of the five platforms, two are based in London, two are based in Cape Town, and the fifth in Lagos. This clustering of entrepreneurs in a narrow field is reminiscent of two Impact Bonds emerging in Rajasthan, and another two in Cameroon – more or less at the same time – when there were only six examples globally. Hotspots of creativity or innovation seem to spark, and it bears examining more closely whether there are predictive indicators, such as the accidental or purposeful rise of communities of practice, that could be harnessed to accelerate development and uptake of emerging technologies¹⁰.

¹⁰ There is an increasing body of literature on innovation clustering building on the seminal work of Michael Porter in the 1990
stratigos.comCompetitive Advantage of Nations

APPLICATION DEEP-DIVES

1. FROM THE BOTTOM UP – SELA

SNAPSHOT OF SELA'S APPLICATION 
<p>Established: 2017</p> <p>Arena of operations: Nigeria (Niger Delta), Ethiopia</p> <p>Funding approach: Tokens, Equity, Grants</p> <p>Primary forms of tech used: DLT, AI on Web and Mobile</p> <p>Evidence of user: 7 projects listed on the application</p> <p>Impact focus: SDGs</p>
<p>KEY CONSIDERATIONS:</p> <p>Use Cases: 7 live on platform</p> <p>Characterisation of the approach to addressing scale constraints: Bottom-up approach</p> <p>Approximate timeline to scalability:</p> <p>Platforms the application is built on: NodeJS/React, Twilio / Telegram, Mongo / IPFS, Stellar, Ethereum</p> <p>Public / privately available: Private beta for 2019, Public in 2020</p> <p>Use of or intention to ICO, name, amount and value of token: Sela Token, in the Sela Wallet. In Q1 and Q2 we are raising a seed equity round for select private impact investors, and will look to ICO in Q3 or Q4.</p> <p>Addressing token volatility: Currently in design with the Ezra Fund</p>

Why DLT and AI?

The founder and Chief Executive Officer (CEO) of Sela, Chinyere 'Chi' Nnadi, grew up in the Niger Delta; both his parents were environmental engineers, so Chi was painfully aware of the extreme pollution caused by oil spills in the region. His initial response to the problem focussed on deficits in capital, engineering capacity and the ability to execute clean-up programs effectively. Over time, he realised that the problem was actually one of accountability – despite the hundreds of millions of dollars spent on clean-up initiatives, almost nothing was affected on the ground ¹¹ – and no-one was being held responsible for the leakage.

Sela plans to incorporate AI and satellite imagery in the verification process, but for the time being, the original use case is verifying and measuring development projects in the Niger Delta. For example, this includes clean-up operations and affordable housing, which when verified (through community verification agents), get paid from the existing pool of funds available for the purpose.

The need to connect individual responsibility with appropriate capital and incentives was what drove the development of Sela. The ability to create transparency – and immutability – in resource allocation, and match incentives appropriate to different actors, drove the adoption of a blockchain solution. Being able to verify results cheaply and at scale nudged the team towards satellite imagery and AI.

¹¹ United Nations Environment Program Environmental Assessment of Ogoniland https://wedocs.unep.org/bitstream/handle/20.500.11822/25282/ogoniland_chapter1_UNEP_OEA.pdf?sequence=1&isAllowed=y

What does the future have in store?

Sela – like all the applications detailed here – wants to eliminate traditional barriers to capital flow into emerging economies, by introducing trust and transparency into transaction and tracking resource flows on the one hand and measuring impact on the other. Their approach though differs from the other four applications because the Sela Portal, Sela Token and Sela Wallet were developed to address a specific local challenge – lack of accountability in last mile. Because it has shown promise in the first use case by ensuring that no payments are made for oil clean-ups unless they have been independently verified by trusted community members, they are expanding outwards to other use cases, using the same architecture, where accountability and transparency are also lacking. Diagram 7 demonstrates Sela’s ambitious path to scaling.



DIAGRAM 7 Sela's Roadmap 2017-2019

While in some ways the least scaled of the five applications, there's something deeply compelling about the approach that Sela is taking. They are building solutions to pressing local challenges using the best and the brightest from the region. By luring away MIT graduates from Uber, Google, Facebook home to use their formidable skills they seek to make a difference in a way that the most well-meaning Silicon Valley entrepreneur or committed development professional is unlikely to be able to match.

Their vision for the future is grounded and realistic. They are not building their own blockchain, and indeed are agnostic as to which they use, switching from Ethereum for their data requirements, to Stellar for the financing transactions, and potentially using permissions platforms for sensitive data¹².

They are partnering with École polytechnique fédérale de Lausanne (EPFL or the Swiss Federal Institute of Technology in Lausanne) to develop solutions to unexpected challenges encountered in their early pilots using computer vision and voice recognition. The computer vision application will be able to make extremely sophisticated AI analysis of pollution, clean-ups and attributions from satellite images, and the two-year research programme will commence in April 2019. A voice recognition solution may be developed as many of the community verification agents in the Niger Delta are community members with very low levels of education, and even feature phones were posing digital literacy issues.

The cost of satellite imagery came up several times as a limiting factor for a variety of solutions owing to the expense – up to USD 60/m². Sela has a Memorandum of Understanding with Human Rights Watch, who procure satellite imagery from the German Aerospace Centre. An 'in-principle agreement' exists with Planet Labs, a private Earth imaging company, to buy commercial satellite data from them at USD 800/month once the model becomes commercially sustainable.

Sela's second use case relates to an affordable housing initiative in East Africa that is forecast to commence in late 2019. This initiative could have global implications for how affordable housing is developed and managed through its entire lifecycle in the future. Each house will be tokenised. Builders will be paid once satellite imagery and AI-driven computer

12 See Glossary of Key Terms.

vision have verified pre-agreed milestones of the build. The title and deed will be housed on the blockchain. And then the workers will pay with tokens or fiat until they have paid off the property and own it themselves – which will again be recorded on the blockchain. As a significant added benefit to the economy, all payments, rental or otherwise, will be transparent to the tax authorities, ensuring no revenue leakage.

Interestingly considering the responses from the other four applications, Sela views its primary vulnerability as people. This involves getting the right technical people with the background and customer intimacy to understand how to build in the emerging world that are ready to roll up their sleeves, getting the right team around Chi so he can focus on the role of CEO, attracting the highest calibre specialists, and perhaps most importantly, managing the culture of teams spread from the West Coast of the US to the west coast of Africa. The time zones are difficult, and erode cohesion, but the biggest disconnect is that it's not possible to develop strategy in Palo Alto when the solution needs to meet the needs of countries in Africa.

Sela Board Chair Andrew Dell, former CEO of HSBC Africa, made an interesting point that was in some ways echoed by other respondents. Sela may be able to develop a truly efficient, transparent and powerful platform to facilitate the flow of investment dollars into Africa – indeed they are highly motivated to do so, because of the absolute need. However, key barriers persist. For example, will impact investors and donor agencies will be able to innovate as quickly? Are they able to transform themselves to be nimble, lean and commercial enough – like their non-impact-oriented cousins – for their demand to meet the pipeline of opportunities that Sela and others will supply?

That aside, Sela is not the only bottom up approach that donors will need to respond to. Initiatives such as Grassroots Economics, led by Will Ruddick, the Healthiest Village, led by Ariel Lashansky, and Shanzhai and i02 Foundation led by Tat Lam (all of which are detailed in Annex 3) all lend weight and credibility to the high value of high-quality local solutions being developed using a bottom up approach.

2. HARNESSING THE MAKER'S CULTURE¹³ – PROOF OF IMPACT

SNAPSHOT OF PROOF OF IMPACT'S APPLICATION	PROOF OF IMPACT
Established: 2017 Operational footprint: Ethiopia, South Africa, India Funding approach: Equity seed funding + grants + partnership revenues. Currently closing Series A equity funding. Primary frontier tech used: DLT Number of uses: 3 use cases Impact focus: Financial services, Health, Education, Climate Change	
KEY CONSIDERATIONS: Use Cases: 3 live on platform Approximate timeline to scalability: 3-5 years Plan to address scale constraints: Clear Roadmap + continuous optimization & iteration Platforms the application is built on: Ethereum, MetaMask, Etherscan Public / privately available: Privately Use of or intention to ICO, name, amount and value of token: No ICO planned. Performance-based tokens specific to PoIP, structured as non-fungible token (ERC721). Addressing token volatility: irrelevant (non-fungible token follow impact market pricing) White Paper: https://proofofimpact.co/whitepaper/	

¹³ See Glossary of Key Terms.

Why DLT?

Proof of Impact was founded in 2017 to enable purpose-driven businesses to build and maintain their own impact tracking infrastructure, (e.g. monitoring and evaluation departments, tracking forms, audits, etc.) through an Ethereum-based core blockchain infrastructure with inputs and verification capacity from drones, satellites, IOT or any other acceptable, objective form of verification. They are also experimenting with AI and machine learning to be able to extrapolate results from limited samples of remote sensors with a high degree of confidence.

Proof of Impact's approach to scale is likely built off the learning experience of one of its two founders, Iulian Circo, who founded the Triggerise platform in 2014. Triggerise delivered 'event-triggered transfers' where donors provide funding to both pay for services and reward users when they complete certain predefined events. Through Triggerise, hundreds of thousands of users received rewards (e.g. cash, mobile credit, tokens) based on the completion of actions. For example, pregnant women in India received Tiko tokens, reimbursable at participating shops, for completing a healthcare related pregnancy milestone.

In 2017, Iulian left Triggerise and with co-founder Fleur Heyns created Proof of Impact to focus on the potential of emerging technologies for impact delivery, results measurement, and funding – both public and private. Iulian's long history in implementing development activities on the ground in emerging economies strongly influenced the very pragmatic approach Proof of Impact takes to building the ecosystem. They focus on finding partners to develop and roll out new use cases with, and then building necessary elements of the ecosystem when the need becomes evident. Proof of Impact also prefers to partner with large-scale established organisations such as major foundations and international donors, rather than remain in the innovation ecosystem, in order to improve the chance of scaled uptake.

While Iulian drives the implementation side of Proof of Impact, he acknowledges that the impact capital side of things is a steep learning curve for him. Fleur brings many years of impact investment and FinTech experience, which ties together the Proof of Impact offering in a very interesting way. Proof of Impact has a strong relationship with a Swiss cryptocurrency exchange called Lykke, which has a strategic relationship with a Dutch securities exchange platform Nxchange, and the three organisations teamed up to be able to offer a fully regulated tokenised securities exchange. This angle gives Proof of Impact the unique prospect of being able to trade Performance-based-Tokens ("PBTs") and issue securities in the form of Tokenised Impact Investment Products ("TiiPs") with very short notice, and distribute them to both retail and institutional investors, something that no other platform currently can offer.

The applications architecture is based on key components including:

- Event Verification Technology: a layer that allows the verification of events at scale, including through IOT, biometrics, audits, etc.
- Core Platform (DApp): tokens get generated corresponding to specific events, which are embedded in a smart-contract layer.
- Dashboards: investor-facing reports allow live tracking of progress.
- Wallets: user-facing wallets combine verification and payment features and include cooperative wallets with governance modules.
- Financial engineering; creating impact investment products out of the verified impact events and pricing them for investment and trade.

Building upon this architecture, Proof of Impact can offer users several products. These products are currently being tested through use cases, but there is no substantive evidence generated yet demonstrating their efficacy. In Ethiopia, PBTs started being tested as a funding mechanism for immunisation in hospitals in Ethiopia in the first quarter of 2019.¹⁴ The Netherlands government will purchase tokens from the implementer (Cordaid) at an agreed upon price for delivery. Fair Pay, a mechanism for tracking tokenised commodities through their value chain, allows for smart contracts to release payments into community wallets as the commodities are transferred up the value chain. Other investment products are also being tested on the platform, including bonds, securitised loans, and other instruments.

¹⁴ <https://proofofimpact.com/introducing-performance-based-tokens-next-generation-blockchain-powered-performance-based-54e1b39eab6d>).

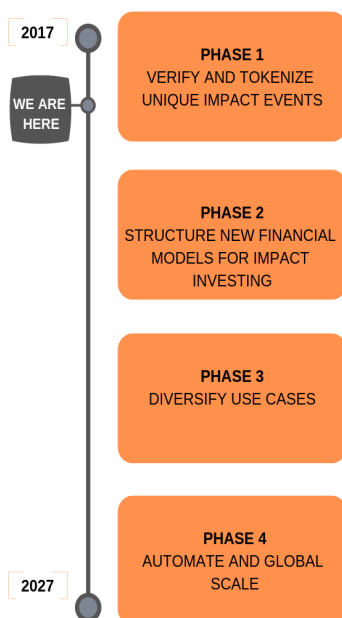
What does the future hold?

Proof of Impact's approach to encountering a roadblock is to build another solution to address it. A Proof of Impact initiative – still on the drawing board – focuses on reducing deforestation in Madagascar plans to use the platform, combined with satellite imagery to reward communities in line with forestation outcomes. By having a scientific team track reforestation in real time through drone and satellite images funders could deliver payments directly to the communities managing the forests, into community wallets.

Another welcome contribution or the Proof of Impact methodology is at the level of issuing tradeable impact investment products based on verified SDG outputs. This bottom-up approach will be piloted in the world's first "SDG Merchant Bank" with Africa as its first geography. Rather than issuing investment products top down and then struggling to verify or attribute the impact, events will be verified as they happen, tracked, priced and structured into SDG investment products that investors can hold or trade. This SDG Merchant Bank is to launch in January 2020.

Proof of Impact retains a very open mind to any and all technologies which will make results verification more streamlined. They are in final stage discussions with a major foundation to tackle drug-resistant tuberculosis in India using a combination of cutting-edge biometric identification tech, remote IOT sensors that accompany the medicines through the cold-chain, and a tokenised incentive structure. The Proof of Impact approach epitomises the Maker's Culture in frontier technology – develop use cases, figure out how to make it work, where the gaps are, how to fill the gaps and connect disparate solutions to best effect, and how the new, more holistic solution can be used elsewhere to even greater effect.


A noticeable aspect of the Proof of Impact culture is a sincere belief that competition is healthy, and should be viewed as market validation, with improvement coming through a process of learning by trial and error of all actors in the market. There is no firm view on whether segmentation, consolidation, or winner takes all will define the frontier technology results to finance nexus – but Proof of Impact doesn't seem to care much – so long as integrity and impact remain at the heart of the ecosystem.



Proof of Impact is setting out to prove that impact can be profitable and therefore the company is set up as a for profit B.V. in the Netherlands, to "walk the talk". Like many start-ups, growth capital is likely to be Proof of Impact's biggest barrier to scale and its vulnerability. They have raised initial seed capital and are following up with a Series A. Additional sources of capital will come from; commercial contracts to fund growth, grants from international donors and foundations to fund new use cases as well as transaction revenues from the platform. The contracting and disbursement cycle of foundations and major donors is notoriously slow, and cash flow is the killer of most early-stage businesses. All going well though, Diagram 8 shows how Proof of Impact laid out its 10-year growth plan.

DIAGRAM 8 Proof of Impact Growth Plan 2017-2027

3. ENSURING REGULATORY COMPLIANCE – ALICE

SNAPSHOT OF ALICE'S APPLICATION 
<p>Established: 2016</p> <p>Arena of operations: UK (projects under development in the USA, Japan, Colombia and Brazil)</p> <p>Funding approach: Grant money and equity funding</p> <p>Primary forms of tech used: DLT, MEAN stack</p> <p>Evidence of uses: St Mungos, two live pilots, three initiatives to be launched this year</p> <p>Impact focus: Cross-sector payment-by-results platform focused on providing transparent impact data to donors, grant makers, impact investment funds and the general public.</p>
<p>KEY CONSIDERATIONS:</p> <p>Characterisation of the approach to addressing scale constraints: By the Book – focused on legal / regulatory, focused on usability research for non-technical users (UX R&D funded by Innovate UK grant).</p> <p>Approximate timeline to scalability: Outcome payments already scalable, investments under compliance review.</p> <p>Platforms the application is built on: Ethereum, Mango Pay, MakerDAO (Dai stablecoin)</p> <p>Public / privately available: Built on public blockchain, permissioned.</p> <p>Use of or intention to ICO, name, amount and value of token: Potential ICO in the future to implement a decentralised governance mechanism, but core functions do not require a dedicated token.</p> <p>Addressing token volatility: Use of fiat-backed and crypto-collateralised stablecoins.</p> <p>White Paper: https://github.com/alice-si/whitepaper/blob/master/Alice white paper - FV 0.9.pdf</p>

Why DLT?

Alice has from the outset grounded itself in the reality of financial markets. This is largely due to the highly practical approach of CEO Raphael Mazet and his executive team; their approach is very grounded in the real world of unlocking private capital, but expect the blockchain to be able to democratise impact investments and enable them to scale exponentially.

The Alice team looks for compliant ways that the landscape of outcome funders and impact investors can use their platform, which is for most intents and purposes ready to scale once the capital flows can be unlocked; the outcome payment side is fully compliant in the UK, and the impact investment platform is currently undergoing compliance review.

That is not to say they are not constantly innovating as well – they must be highly creative to achieve their goal; an application that everyone from major institutional investors to the retail investor sector will feel as confident in investing in as they do the London Stock Exchange.

Alice may be the application that has come closest to developing and implementing a complete solution connecting the finance to results to payment cycle, albeit not at scale, and with a couple of workarounds. The St Mungo's homelessness social impact bond is the first payments-by-results project to be put on the blockchain. However, it only addressed the outcome payment side of the equation; there was no impact investment involved.

This intervention aimed at getting rough sleepers in London into stable accommodation. Fiat donations¹⁵ from the public were held in a segregated account and represented on the blockchain as tokens. Once the agreed specific impact metric targets were verified, St Mungo's received tokens representing the donations that it could redeem for the corresponding amount of fiat held in the segregated account.

The segregated account solution described above was provided by Mango Pay.¹⁶ This pragmatic solution exemplifies the Alice approach: innovation is key, but not worth that much unless you can make your innovations accessible to the mainstream through regulatory compliant existing systems. Alice also started integrating the use of a so-called "stablecoin"¹⁷ called Dai for donations. This allows people to donate in cryptocurrency, which is automatically converted

¹⁵ See Glossary of Key Terms

¹⁶ https://www.google.com/url?q=https://www.mangopay.com/en-UK/@sa=D@ust=1549096149211000&usg=AFQjCNEYj3b_4d65yYRNmkCb3F1UsNZAEw

¹⁷ <https://en.wikipedia.org/wiki/Stablecoin>

into a stablecoin, hence solving the volatility conundrum. Donations made in fiat will still work according to the same segregated account system for the foreseeable future, at least until the stablecoin sector matures.

In terms of the application, Alice has a robust technical infrastructure – or rather set of platforms. Through a solution where they ‘burn’ tokens once the agreed result has been verified and paid out, they secured for Gift Aid status from Her Majesty’s Revenue and Customs (HMRC). As noted, Alice’s aim is to be able to reach as broad an audience as possible, so it was important that their charity clients could claim GiftAid. HMRC allowed this, and more generally tax relief, if it was applied to donations only once they are paid out, to avoid a messy tax clawback in case donations are reimbursed to donors (e.g. if the charity does not achieve its targets).

The token Alice uses to represent donations is pegged 1 to 1 to the GBP. This is like Tether, a stable coin designed to be pegged to the price of the USD. Addressing the super-volatility of many cryptocurrencies is necessary if the use of this specific technology is going to go to scale. In future, Alice will likely use Dai, which is pegged 1 to 1 with the USD through a crypto-economic over-collateralisation of the coin with Ether, the second-most valued cryptocurrency after Bitcoin, and if there were a cryptopound issued by the Bank of England, Alice would adopt it immediately – again reflecting their aim of integrating with mainstream solutions in order to make Alice accessible to the greatest number of people and institutions.

There are broadly speaking two types of stablecoins: the first are pegged coins, which are backed 1-to-1. Tether is the leader but very opaque, and a number of others like Gemini (founded by the Winklevoss twins) and TrustToken (backed by Andreessen Horowitz), amongst others are increasingly popular. HelloGold uses gold as a pegging mechanism. The second are collateralised coins such as Dai and Havven.

What does the future hold?

While the demonstrated use cases of the Alice platform (St Mungo’s, which ended in late 2017, two ongoing live pilots, and another 3 to be launched in the coming months) relate only to donations, the vision is very much to use the same underlying technology to facilitate impact investments at all ends of the scale spectrum. Diagram 9 charts the full suite of Alice products, along with their state of development.

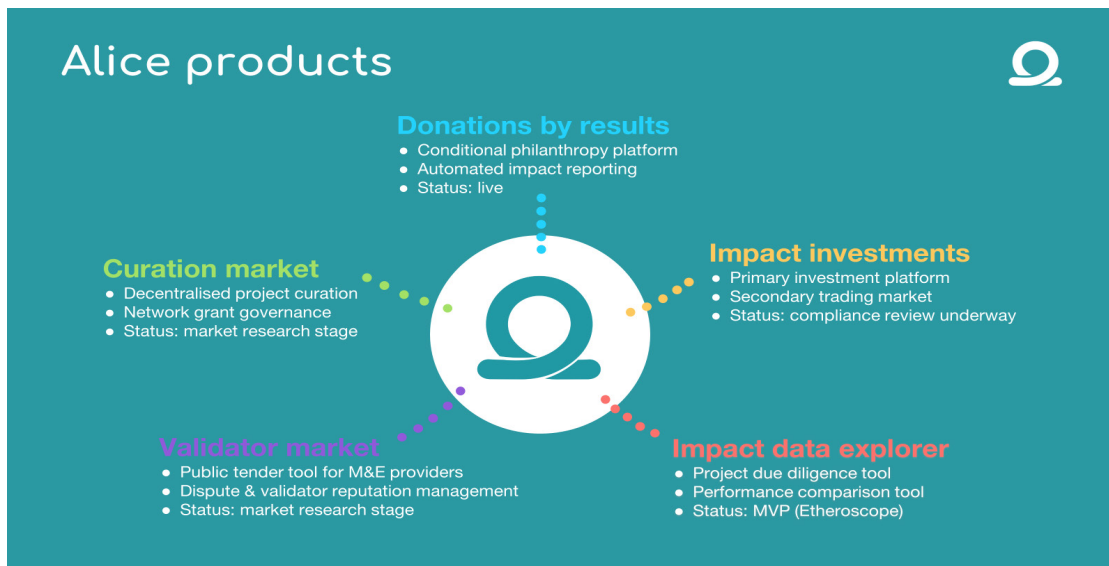



DIAGRAM 9 Full Suite of Alice Products and stage of development

The main vulnerability that the Alice team is facing is lack of understanding (and risk-averseness) from impact investors about the blockchain, cryptocurrencies and tokens on the one hand (largely due to the boom and bust hype of Bitcoin), and lack of clarity of the regulatory and legislative environment on the other.

Finally, the bulk of Alice's experience in the finance-results-payment space is in the UK, but there's no reason why the underlying infrastructure shouldn't stand up in emerging economies and internationally. Indeed, they are working in the US, Japan, Brazil and Colombia to understand the licensing requirements of each country, to be able to articulate the risk of raising funds through their platform, and to identify partners with a compatible risk-readiness. Alice has partnered with K-three, a financial intermediary in Japan (who supported the launch of the country's first social impact bond) who they are structuring local projects with. The projects currently live on the platform are in Russia and Nepal. They are also backed by Impact Assets, an impact investment fund in the US who are helping them to navigate the local environment there.

The application appears ready to scale. It's the developing and emerging market applicability, the complexities of entering new markets with their own unique regulatory frameworks, and the suspicion and risk-aversion of investors that could impede Alice's ability to scale in the short-term. The coming year, as they launch their first international projects, will be critical for determining whether they are able to reach their potential, and this includes generating a solid evidence base of the benefits of their platform which is still absent.

4. ALIGNING GLOBAL TECHNICAL PROTOCOLS – IXO

SNAPSHOT OF IXO'S APPLICATION 	
Established:	2014 (Open-source Foundation established 2017, Public Network launched December 2018)
Operational footprint:	International
Funding approach:	Tokenised debt fund with share of network revenues
Primary frontier tech used:	DLT, Decentralised web standards (Web 3.0), decentralised databases, IOT compatible, verification oracles, automated payments
Evidence of uses:	3 strategic partnerships being implemented, including for impact bonds
Impact focus:	Renewable energy, Reforestation, Citizen Engagement, Education
KEY CONSIDERATIONS:	
Approximate timeline to scalability:	18 months (assuming positive funding and legislative factors eventuate)
Plan to address scale constraints:	Decentralised Internet Standards (Web 3.0) and distributed network
Platforms the application is built on:	Ethereum, Cosmos-Tendermint (custom blockchain)
Public/private available:	Public with membership sign-up
Use of or intention to ICO, name, amount and value of token:	IXO fee tokens. No ICO.
Addressing token volatility:	Not Applicable.
White Paper:	https://ixo.foundation/wp-content/uploads/2018/08/ixo-Technical-White-Paper-w-Cover-Version-3.0-8-December-2017-1.pdf

Why DLT?

Dr Shaun Conway is a medical doctor, development professional and a technologist, who has worked on accountability and data-driven development initiatives - including as founder and director of IHP+Results, the monitoring and accountability mechanism for the International Health Partnership – his entire career. He saw the blockchain as a way to bring rigour and transparency into a field that was often obfuscated by noble ideals, but without the accountability the serious endeavour of international development requires.

ixo.world is a Web 3.0 ¹⁸ network built by the open-source non-profit ixo Foundation, founded by Shaun. It is based on research and development into core technical protocols and internet standards for digital identification, data verification and impact quantification that he began in 2014.

ixo is a public blockchain network secured by delegated proof of stake, custom-built with Tendermint-cosmos for interoperability with the future vision of the 'Internet of Blockchains'. For project implementers, ixo provides a highly configurable shared data infrastructure that is relatively easy to deploy and scale for most types and sizes of projects.

For software developers, ixo provides protocols and a shared platform on which to build data-driven applications and services, such as smart impact bonds that are programmed to autonomously allocate capital to optimise sustainable development results with financial returns.

The ixo Foundation originated from a project called Amply, where in partnership with Innovation Edge (backed by Omidyar Network) and with funding from UNICEF Innovation, a mobile application and school attendance tracking data platform was built using ixo protocols to demonstrate how the paper-based attendance claims for a national pre-school early learning subsidy scheme from the South African government could be replaced using private and secure digital tracking, with automated claims submissions and processing. Amply was piloted in 87 Early Childhood Development centres with over 80,000 attendances registered. Although verification of these claims was still manually performed through supervisory visits to centres, the system demonstrated how duplicated claims could be eliminated and real-time attendance data could be used to improve service management by reducing costs associated with the claiming of a per child subsidy. Scale-up of this platform is now dependent on government procurement processes.

The ixo foundation was established in Switzerland to internationalise the protocol which has evolved from the Amply product research and development, to provide an open-source governance mechanism (on the model of the Linux Foundation in the US).

ixo created a blockchain-based infrastructure to manage and fund projects, using Web 3.0 technologies (i.e. DLT, 5G, digital currency, sensors, etc.). ixo has released open-source modules that include decentralised project data stores, a web explorer module enabling anyone to launch projects, search and view all network projects and transactions, with real-time performance dashboards, project libraries, a mobile App and Wallet, IoT sensor integrations, smart contracts for impact bonds, and other 'building blocks' for a comprehensive decentralised digital platform. ixo – like WWG and Sela – created their own blockchain – although ixo has also built a two-way bridging mechanism between their blockchain (the ixo-Cosmos blockchain) and Ethereum, with plans to integrate ixo into other blockchains over time. A comprehensive description of ixo's offering is contained in their white paper (link in box above).

The products key features include:

- Launching a project: this provides a customisable data management and storage solution for projects of all sizes to quickly deploy their own project requirements from the standardised libraries. Includes strong privacy, data protection and sovereign ownership. Project data stores are hosted in whatever hosting territory or infrastructure a project owner chooses.
- Coordinating and incentivising agents to deliver services: with a mechanism to identify and authorise (using self-sovereign digital identity credentials) people, machines or software services to perform work on projects and submit digitally signed claims. Once claims are verified (approved), the agents can be paid (on or off-chain) for their results.
- Investing for impact: programmable capital applications such as simple escrow or more complex impact bond instruments are built on the ixo protocols, using the ixo network as an oracle that triggers (signs-off) on transactions once claims have been verified. Other fundraising (such as crowd-funding) and decentralised finance applications (DApps) on the Ethereum and other networks will extend the capabilities of projects running on the ixo network.
- Verifying results: claims are recorded in a high-definition data format that is evaluated by traditional mechanisms, or with the assistance of algorithmic evaluation and predictive analysis, referencing external sources of information. Verified claims include a digital proof and are uniquely identified as digital assets that have a value.
- Building applications: developers create customised or new solutions using the standard ixo protocols, shared data and network infrastructure
- Sharing data: ixo serves as an index to all projects and data resources that can be explored and accessed through the network in a safe and privacy-preserving way that (with permission from project owners). ixo is collaborating with the Ocean Protocol to build an incentivised decentralised data marketplace sourced from all projects using the ixo network. This will enable training of machine-learning, meta-analysis across geographies or sectors and many other data-driven applications.

What does the future hold?

ixo has played an active role in the establishment of the new internet standards that will govern these various platforms. As described by Shaun in a recent blog post launching ixo.world,

“Participating in community groups across the world, we have discovered and contributed to core internet standards for self-sovereign digital identity and verifiable claims, using high-definition data. As these new standards become part of the web we use every day, this could enable people, organisations and machines to coordinate more effectively to scale impacts through decentralised webs of trust. By applying these new information technologies in the ixo protocols for sustainability, we believe that it is now possible to change the rules for how impacts are identified, measured, factually verified and valued.”

This approach captures ixo’s perspective on tackling the entrenched ecosystem constraints. Shaun, as a medical doctor who has worked with normative agencies such as the WHO, is very familiar with standards-development processes and how standards and protocols are used in practice – for instance to treat patients in a consistent and high-quality manner using normative guidelines. Similarly, ixo is working as part of a global community of technology experts to hardwire standards into all internet browsers that will be able to securely communicate impact data in a standardised manner, using the W3C protocol. Diagram 10 below demonstrates some of the technical protocols ixo contributed to establishing. The approach is highly technical, working in a systems approach with high-end partners including Rebooting the Web-of-Trust and borrowing engineering-based approaches to the development of technical standards that do not look out of place in robotics.

ixo Protocols identify claims, verify data & generate liquid assets

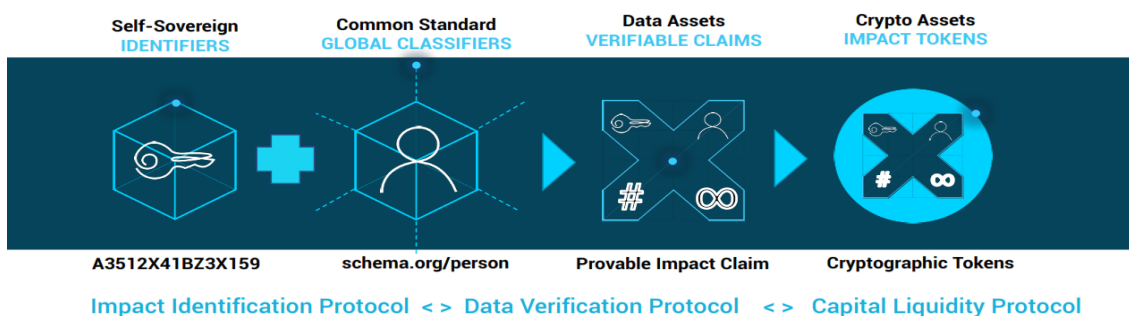


DIAGRAM 10 ixo Technical Protocols

ixo is also starting to work with the Global Impact Investing Network’s Impact Reporting and Investment Standards (GIIN IRIS) and the Global Reporting Initiative (GRI), to translate their indicator frameworks and impact management rubrics in semantic, interoperable standards that will interconnect data graphs. This standardisation will be key to enabling processes that enable public good uses of data, such as research, benchmarking, etc. which now are all very much custom-built to each exercise.

ixo is implementing a range of use cases and has established many partnerships with recognised development agencies and enterprises. The ‘showcase partnerships’ demonstrate the various functionalities of the ixo.world platform. A recent Medium post ¹⁹ describes how for the three projects, users can register either as funders – by purchasing subscription packages of ixo tokens, or service providers.

Extremely relevant to this report is a piece of work that ixo has been contracted by the UBS Optimus Foundation to demonstrate how their programmable capital mechanisms can be used to implement development impact bonds, in the context of in the Quality Education India DIB. The hypothesis is that this results-based financing instrument can

19 <https://medium.com/ixo-blog/welcome-to-ixo-world-194dc17cb6d9>


be unitised and decentralised to level of individual intervention sites (schools, in this instance), to enable bottom-up origination and scaling. The work began in early 2019. This will include token systems engineering, application development, consensus-building on technical standards, reference code implementation and field-testing of the application in a pilot number of schools, with the contracted independent evaluator in the DIB (Gray Matters International). The emphasis of this work will be very focussed on verified claims data collected and integrate this with smart contract triggers, providing performance tracking. Value-transfers of payments to service agents and contractors using crypto-tokens will be possible, but is unlikely to be adopted immediately by financial institutions, with this likely to still be three to five years away.

At this point the platform is largely about having impact data captured in a high-definition standardised format, with verification results recorded for posterity and transparency. Funds need to be raised in order to build out the rest of the capabilities, but ixo does not want to do an ICO as there is a concern about the value of ixo being undermined by speculative investors. Similarly, grant funding will not be enough for their growth needs, as donors are generally reluctant to fund core operations and tech build-out. This remains an open question to be resolved, and may impact on the planned go-live of the full suite of capabilities, including the programmatic capital raising function and the retail investment option, by the end of 2020.

The potential to trade tokenised outcomes, which are the digital assets produced using the ixo protocol, will be critically dependent on the regulation of security tokens that are linked to the issuance of impact financing instruments such as impact bonds. Lack of flexible untied funds and delay in this legislation could significantly push out the development and roll-out of the ixo vision to provide a new mechanism for financing development outcomes through tokenised and programmable funding mechanisms.

In the next phase of implementation, to grow into a global public utility, ixo plans to reconfigure the organisational structure to form a networked cooperative that is funded through a tokenised debt fund. This will provide a share of network revenues to the holders of ixo staking tokens. A public Security Token Offering (STO) may be launched during 2019. As of February 2019, ixo has had to scale back on its team due to funding constraints while the new funding mechanism is put into place.

5. COLLABORATING WITH DISPARATE ACTORS - G17 ECO WORLD WIDE GENERATION

SNAPSHOT OF WWG's APPLICATION	 G17Eco WORLD WIDE GENERATION
Established: 2017 Arena of operations: International, London HQ Funding approach: Equity funding Primary forms of tech used: DLT, cloud-based micro services, proprietary Universal Trackers Evidence of uses: Unilever South Africa project, created digital model of the initiative, tracked 150,000 data points in 300 schools with 4400 learners, mapped 13 SDG targets, integrated 65 videos and 650 images to populate 8 dashboards. Impact focus: SDGs, supports tracking organisational KPIs, can support any impact framework	
KEY CONSIDERATIONS: Approximate timeline to scalability: 12-18 months Characterisation of the approach to addressing scale constraints: Collaborative, open source, flexible to existing and future frameworks. G17Eco doesn't need to be integrated into legacy systems. In the cloud, user permission based SaaS platform. Platforms the application is built on: Fully flexible proprietary system on Node framework Public / privately available: Privately for G17Eco member users Use of or intention to ICO, name, amount and value of token: Not yet Addressing volatility: N/A	

Why DLT?

WWG describe themselves as an accidental green fintech company – Founder and CEO Manjula Lee started her career at Shell in Mergers and Acquisitions and Strategic Partnerships before moving into the non-profit sector. It was the

realisation that overbearing bureaucracy, duplication, and a lack of effective monitoring and verification systems were leading to siloed programme delivery, distrust and fragmented solutions that led her to found WWG. Manjula initially conceived WWG as a Fund Manager creating SDG-aligned impact investment products, but soon realised that it was the co-ordination of all the actors, the monitoring and measurement of where the money goes and how the returns are made that was the missing piece - hence the birth of the G17Eco application.

With a leadership team consisting of finance, technology, sustainability and development professionals, WWG developed G17Eco to deliver real time monitoring, reporting and verification (MRV) of the financial and impact performance of any type of investment or initiative across any sector, while aligning the performance with the framework of the SDGs. This insight should enable organizations to more actively manage their activities, increase their effectiveness, reduce risk and enable increased funding and partnership creation.

WWG is focussing on developing G17Eco to support four sectors to meet their SDG targets: investors looking for verifiable impact and to more actively manage their portfolios; businesses looking to ensure their sustainability initiatives are making a difference and inform their shared value strategies; governments and donors who want to ensure their development dollars are generating the desired results and course-correct where needed; and service providers who want to be able to show their donors and supporters the effectiveness of their activities and increase fundraising effectiveness.

Through this inclusive approach WWG hope to become a dominant actor in the MRV space, connecting private capital, corporate sustainability results, service provider results, and government and foundation payments in a solidly structured platform to help accelerate the financing of the SDGs.

WWG's application is primarily for large organisations who have multiple initiatives or investments (often in different geographies), who want to be able to make the result of these initiatives visible to all their stakeholders in a standardised and aggregated manner. Using the SDG Goals and Targets, WWG will map these multiple organisation-wide initiatives to the SDGs (and other key performance indicators (KPIs) of their choice) and aggregates high volumes of data onto a range of dashboards to monitor and measure financial and impact performance, from the global level all the way to the beneficiary level. The model allows for reporting at sub-national, national and global levels, and through proprietary algorithms identifies synergies across initiatives and provides analysis on maximising impact, as well as converting raw data from multiple sources into a scorecard using its unified, open-source, SDG digital index.

By connecting financial metrics with impact data, WWG aims to drive efficiencies and enable organisations to manage both partners and budgets in complex initiatives more effectively. Using smart contracts and their process automation "Management Frameworks", WWG will hardwire efficiency, accountability and cost control into G17Eco.

One of the main constraints to any of these platforms is results verification. WWG uses proprietary Universal Trackers (UTrs) – essentially data bots – to collect both the data as well as the supporting proof (e.g. who or where did the data point come from, the date and time plus documentary evidence including media files). By capturing this data as one package and appending it to a private distributed ledger, it demands the submitters and verifiers 'stake their reputation' to the results, thus driving higher quality contributions, and reducing corruption. Every data point and process flow is immutable and traceable, providing a chain of provenance for anyone who want to interrogate the data. Diagram 11 describes the key functions of the G17Eco application.

G17Eco provides a digital **end to end solution** to help you execute SDG investments at scale

G17Eco helps you deliver the 5 M's:






-  **Map:** investments and initiatives to the SDGs and specific organisational targets. **Compatible with major frameworks and regulation.**
-  **Manage:** multiple stakeholders and their activities throughout the entire investment chain via digital management frameworks
-  **Monitor:** Universal Trackers (UTRs) are our proprietary data bots which provide low cost, real time data collection, processing & verification, underpinned by Distributed Ledger Technology
-  **Measure:** Our UTRs have built in algorithms to convert raw data into performance measurement dashboards and reports, from beneficiary level right up to global contribution to the SDGs
-  **Market:** Permission based dashboards enable you to easily publicise and market investments to unlock resources



DIAGRAM 11 Description of WWG's G17Eco Application

What does the future hold?

WWG have a pipeline of high-profile 'lighthouse' clients that they will be working with to on-board onto their platform. Using the next eighteen months to work through the on boarding process and understand the needs of the different categories will enable WWG to streamline the process, offer additional value for each of the four categories, and open up to the global community shortly thereafter, with a forecast to have a portfolio of billions of pounds of impact initiatives hosted on G17Eco within three years.

Like all the other platforms, WWG has its strengths and its weaknesses. Coming from a private sector background, WWG understands systems and business processes and corporate communications and reporting requirement extremely well, but it may be that they underestimate the time it will take to engage public sector actors. This could impact on the proposed timelines, but WWG has vocal support at the highest level of government in the UK and the City of London, and if they can continue to bring global impact leaders like Unilever on for the long journey ahead, this will give them a great deal of momentum – which will need to be backed up by evidence.

ANALYSIS

Amara's Law: *We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run.*

When World Economic Forum founder Klaus Schwab first popularised the concept of the Fourth Industrial Revolution at the beginning of 2016, the blockchain was not listed as one of the frontier technologies about to transform society. Now, after what co-founder and Executive Chairman of Singularity University Peter Diamandis refers to as a prolonged technology 'winter' — or the 'deceptive growth' phase of any exponential technology — use cases involving DLT, AI, IOT, ML, remote sensing, and computer vision are accelerating at an extraordinary rate, with new applications exploding onto the scene.

All five of the companies examined in the deep dives are using these emerging technologies in different combinations with the same goal in mind; to unlock capital – institutional as well as retail – in order to finance Agenda 2030. And they want that flow of finance to be tied to measurable impact. Diagram 12 demonstrates the extent to which each of the applications is focusing connecting finance to results to payments.

APPLICATION	FINANCE	RESULTS	PAYMENTS
Alice	✓	✓	✓
Proof Of Impact	✓	✓	✓
World Wide Generation	✓	✓	✓
Sela	✓	✓	✓
ixo	✓	✓	✓

DIAGRAM 12 Five Applications Focus on Finance, Results and Payments

To unlock impact-linked capital, all the five applications are trying to develop structures that support results-based financing mechanisms and the entirety of the finance-results-payment cycle. At this point, as per the diagram above, none of them have been successful in fully building out a solution that covers all three components at any scale.

To be clear, in impact bonds an outcome funder is still required to complete the cycle by making the payments once the results have been verified, so as the mechanisms stand at present, it's not immediately obvious that any additional capital will be mobilised to address the SDG financing gap.

However, there are several potential ways these mechanisms could unlock substantial volumes of new capital. Firstly, long-term savings resulting from successful preventative interventions could be ring-fenced and committed to further SDG-related activities. Secondly, showing that these mechanisms are cost-effective, efficient and trustworthy is likely to encourage more CSR, or sustainability funds, to be directed into them, rather than into the rather ad hoc types of activities that CSR spend has been associated with in the past²⁰. Thirdly, if crowdsourcing outcome funds can become a reality as envisaged in Diagram 2, individual charitable donations will be able to be channelled into the most effective interventions.

And finally, many of these applications will have impact bonds as only a part of the impact investing opportunity offered. Much of the same infrastructure, including quick, trusted financial transactions and fit-for-purpose and cost effective impact verification will open up investing in social enterprises to retail investors – and possibly allowing investment into much smaller opportunities than are currently available on the market – although undertaking appropriate due diligence on a substantial enough pipeline of opportunities is another problem still to be solved.

Future research should focus on how to make an impact market liquid. There is a clear understanding that this is important, which is why the building out of an ecosystem which would enable trading of impact units is such a priority for all the companies.

Forward leaning professionals like the ones who commissioned this report, and those who contributed to it, understand that it is relatively early days on the frontier technology scene. There are no standards, no understanding of best practice when it comes to combining these technologies, and many smart people are developing their own platforms and applications. Attempts are being made, specifically the Principles for Digital Development, which have been endorsed by over 100 organizations working in international development, to provide a useful model. New America's The Blockchain Trust Accelerator, ConsenSys' Blockchain for Social Good, Fintech for Good, the Global Blockchain Forum, the Beeck Center for Social Innovation's Blockchain Ethical Design Framework for Social Impact and a number of OECD initiatives are also bringing actors together and these efforts should get a further boost from the World Bank's recently announced Blockchain Lab.

However, policy designed to govern human behaviour needs to consider the motivations and incentives driving that behaviour; many founders openly and candidly expressed their ambition to own the dominant platform, positive impact notwithstanding. Therefore, the issue may be how to get the innovators, the inventors, the ones who push the boundaries that little bit more, to move on from the pioneer start-up mentality needed to break new ground, to embracing collaboration and openness. This is particularly challenging given this is a high-stakes environment with the potential for huge dividends for successful applications that are the first to connect finance to results to payment at scale. In *A Guide to the Impact Revolution*, Sir Ronald Cohen estimates that impact bonds could account for USD 3 trillion in investments by 2030.

In the opinion of the authors, each of the approaches is necessary and indeed complementary: technical standards; regulatory and legislative compliance; use cases addressing real challenges; and collaboration between actors will all be needed for the potential of frontier technologies to facilitate and grow the finance-results-payment space.

The last point is particularly important. The approach of the five companies is understandably strongly influenced by the background of their founders and take their strength from this background – but there is a degree of optimism when it comes to understanding the complexity and time required to fill in the other pieces of the scale jigsaw puzzle.

The most important takeaway for this entire report is that to build an ecosystem that will unlock the potential of these emerging technologies, many disparate actors need to collaborate. Diagram 13 demonstrates how the stakeholder groups will be required to work together.

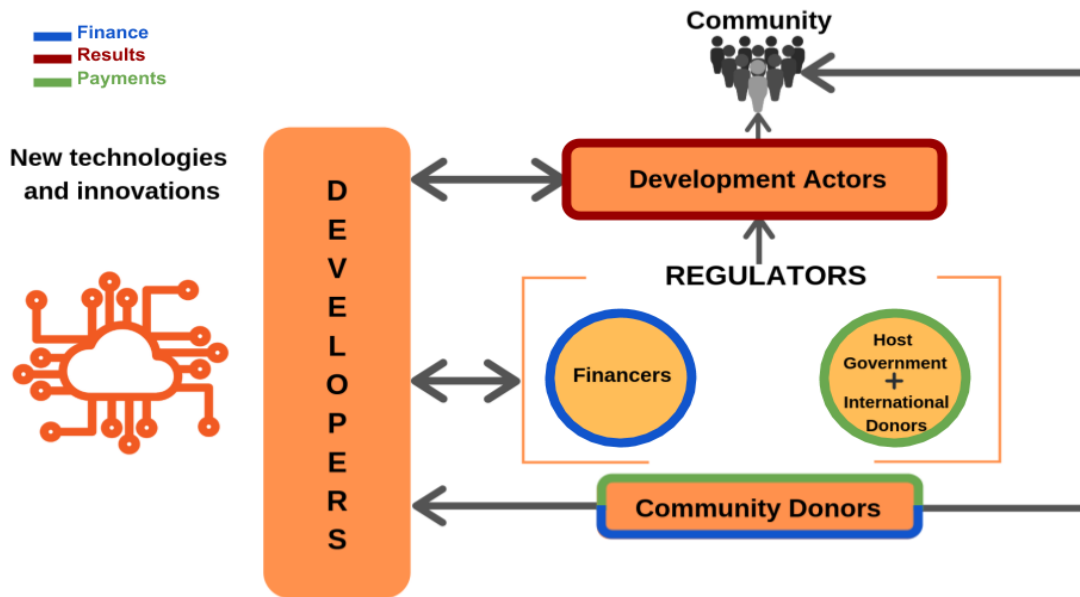


DIAGRAM 13 – Stakeholders Collaboration for the Finance-Results-Payments Cycle

This requires significant work to build out a robust body of evidence across multiple use cases in multiple geographies, to educate policy makers in all parts of the world, and to be realistic about the attributes of different technologies, their undoubted advantages as well as the risks they pose. It also requires managing multi-stakeholder partnerships, which is a complex and time-consuming process; however, one that DFID has substantial experience in.

RECOMMENDATIONS

DFID requested a set of recommendations regarding how the Department could more effectively use emerging frontier technologies and models with a focus on relevance for Impact Bonds, while also discussing lessons for other areas of DFID's programming. Based on the review of the (scarce!) literature, examination of several use cases, and a deep dive on five of the more mature applications, seven recommendations have been distilled.

1. Pathway to self-reliance

There is an important and clear need to support the ecosystem to develop in the Global South. One way of doing this is by proactively reaching out to emerging actors who are on the verge of doing extraordinary things – small outfits who are too busy getting on with their work, or are too far outside the capitals, to be engaging in networking or knowing the available buckets of existing grant or challenge capital that could take their innovations to scale.

A strong emphasis should be placed on providing seed funds and enabling environments for local entrepreneurs to develop local solutions to local challenges using emerging technologies – as is happening in the Healthiest Village in the rural Transkei in South Africa (Annex 3). These communities are problem solvers as a matter of survival – frontier technologies are just new tools.

The work Sela is doing in the Niger Delta is another great example. The transparency and immutability of the blockchain was the right solution to a pressing need to address a clear lack of accountability. The solutions built this way are not hammers looking for a nail to hit, these are solutions using the right tool for the job at hand.

Equally, support should be provided to public sector policy makers so that they can understand the new technologies and support their growth within the borders of their country. This may include providing TA, incubator facilities, legislative sandboxes, or encouraging high capacity government departments to trial them in e-Government initiatives.

Universities and Vocational Training Centres (VTCs) with some existing Information Communication Technology (ICT) capacity should be supported to build out curricula to develop the next generation of coders and programmers and developers.

More of the global dialogue should be held in the global South, and should include field visits so that developers and policy makers in the West understand the reality of the environments that their solutions need to operate in. DFID could play a significant role in encouraging significant dialogue in this area, but it's critical that the major commercial players are involved as well so that it's not seen as a side event.

2. Standards, interoperability and best practice

While this is less relevant for the Impact Bond space specifically, from a broader frontier technology for development perspective it's already getting to be a crowded and messy space. There are already too many different solutions (650 DLT use cases for social impact and counting) built on different applications and with different mixes of technologies for it to be likely that a single dominant application will emerge that could even begin to provide a holistic framework for even current technologies, much less what will inevitably come in the future.

The role of donors is not to support a particular platform over another in any case, as they are seeking commercial viability. However, if DFID, using the convening power of being a significant thought leader in development effectiveness, could pull other donors and multilateral players in to a concerted dialogue on the development of standards and best practice, emphasising issues of inter-operability, efficiency of transactions, robustness of physical infrastructure, concerns of energy resource consumption, this would be real value add, and great use of public funds.

Likewise in terms of articulating best practice and settings standards for the use of frontier technology in development interventions, it's advised to emulate the OECD-DAC Development Effectiveness Standards and the Principles for Digital Development, which have been endorsed by over 100 organizations working in international development. New America's The Blockchain Trust Accelerator and ConsenSys' Blockchain for Social Good are also bringing actors together and these efforts should get a further boost from the World Bank's recently announced Blockchain Lab.

The recent turmoil in ConcenSys, which has had to lay off more than half its workforce, highlights that companies which have technical legitimacy are financially vulnerable, and using public funds to support the work is entirely appropriate.

3. Applying emerging technologies to DFID Impact Bond programmes – using a lean start-up approach

DFID is in the fortunate position of being involved in several impact bonds that are already using best practice to verify and evaluate results. Using these as benchmarks there seems to be a valuable opportunity to roll out technology-based solutions alongside them, and carefully monitor and evaluate what strengths and weaknesses become evident in real-world situations. ixo has been contracted by UBS Optimus Foundation to do a pilot on this starting this month on the Quality Education Impact Bond in India.

Results related to rehabilitation centre construction in the Humanitarian Impact Bond could be validated using satellite technology, and prosthetics could be fitted with remote sensors connected to the IOT to verify their use.

Blockchain smart contracts and financial transactions could be rolled out in Village Enterprise using off-the-shelf products based on the Ethereum protocol, or by partnering with IBM and Worldwide Pay to effect and monitor the flow of funds, particularly as new service providers come on board and the impact bond scales.

From this point on, every time there's a new impact bond contract, DFID could consider bringing frontier tech into the verification and validation part of the cycle, alongside the independent verification agency, so that a significant body of evidence can be generated around what works and what does not.

The newly-formed Impact Bond Market Acceleration Partnership (IBMAP) could be an appropriate forum for not only discussing the merit of the use of different frontier technologies in emerging Impact Bond designs but could also be pivotal in developing a set of guidelines for different technologies for different interventions as the body of evidence is built.

Leverage the lean start-up methodology to quickly assess which technologies are working in what contexts. Encourage innovation and risk-taking (within appropriate boundaries) but push for rapid feedback loops and engage appropriate technical and development expertise to work together to review and adapt and pilot and review and adapt as quickly as possible. Failure should be an option, so long as it's not irresponsible and the lessons are learned!

4. Blended finance vehicles for ecosystem development

There is a real gap in funding of the ecosystem building work. There is a significant role to be played in helping to fund pilots, and proof of concept initiatives, and ensuring that standards established are of high quality. This could be in the form of grants, so long as they are flexible with minimal reporting requirements, or investments. Bamboo Capital recently started the BLOC Fund, which focusses on social impact initiatives using the blockchain that need growth capital. Supporting a new blended fund with a broader remit including grants and TA would add huge value to the growth of this space.

5. Until evidence proves otherwise

Amongst all the hyperbole, marketing, claims and excitement it's difficult for many people to make informed judgements about what works and what doesn't. The availability of substantive data on whether these emerging technologies are delivering on the promise is mostly absent. And for every passionate enthusiast there are legitimate voices asking for evidence that these new technologies do add value and aren't shiny new distractions which replicate last year's mistakes. The only way through this is to encourage absolute transparency in what has worked and what hasn't. DFID and all members of IBMAP should make any non-commercial-in-confidence results and data publicly available, and mandate this transparency in all suppliers, contractors, partners and companies that want to work with any of the IBMAP partners. Funding should be made available for the evaluation of promising new solutions, and the IBMAP knowledge platform should curate a specific section for frontier technology solutions.

CONCLUSION

It's essential to seek evidence that an approach or new technology works before it is invested in, particularly when public funds earmarked for Official Development Assistance (ODA) are being utilised.

The reality is though that at the leading edge of innovation, evidence hasn't been generated yet. At a recent Abdul Latif Jameel Poverty Action Lab (J-PAL) session on Evidence in the Energy Sector at the Commonwealth Development Corporation (CDC), J-PAL noted that there are only five quasi experimental studies in the world on off-grid solar, all based on small lanterns, that show basically no measurable effect on development impact. There is no evidence on anything larger scale (e.g. mini grids, appliances, etc.); and yet many of the Development Finance Institutions (DFIs) are investing in the space, as are many bilateral donors: to keep up with innovation, it appears that sometimes evidence must be gathered as you go.

The technologies detailed in this report are here to stay and are already being used in a range of mainstream use cases, so it's a case of when, not if, they are fully leveraged in a development context (there is a real likelihood that development contexts will actually push their adoption to satisfy needs around transparency, accountability and cost efficiencies that aren't as pressing or apparent in OECD countries). There's also clear potential for their use in broadening both the investor-based and the outcome funder base of Impact Bonds, and for making results verification more robust and efficient, and the entire cycle of finance to results to payment more trustworthy and scalable.

However the most sophisticated technical solutions in the world can't stamp out the potential of inadvertently agreeing on targets that will create perverse incentives, or replace the need for thoughtful impact evaluations. There will remain a pressing need to ensure careful selection of outcome metrics and measurement methodologies; even more so if the level of sophisticated standardisation that will be needed for automated scaling is to be achieved. The policies, procedures, and capacities to ensure this are not yet in place. As the potential for emerging technology to accelerate progress towards the SDGs increases, so to does the need for powerful accountability mechanisms based on considered human judgement.

ANNEX 1 GLOSSARY

Applications A program stored on a remote server, delivered over the Internet through a web browser or mobile interface.

Artificial Intelligence is the science and technology of creating intelligent systems. AI is the theory and development of computer systems that can perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation and interpretation. Artificial Intelligence systems are often enabled by machine learning and apply data-derived predictions to automate decisions.

A growing number of developing countries are using **Biometric Technologies** to create national identification programs or for more specific needs, including cash transfers, voter registration, and disaster relief. Recent research shows how biometric ID through for example iris scanning or fingerprint or palm reading can help improve public service delivery, advance progress on many of the Sustainable Development Goals, and helps shape global best practice in applications that use the technology.

A **Community Wallet** builds on the notion of a Digital Wallet – in the sense used in this document using a crypto-based wallet to store value through tokens or crypto-currencies that are earned and can be spent by all members of a community. Community governance structures are hard-wired into the use of the crypto-funds.

Crowdsourcing is a sourcing model for obtaining information about, input to or funding for a project by making it broadly available to a larger number of people, typically via the internet.

Cryptocurrency is a digital or virtual currency that uses cryptography for security, typically based on DLT.

A **Digital Wallet** is a system that securely stores users' payment information and passwords either on a particular hardware device or in the cloud. This payment information can be fiat-based, using credit card details, or it can be crypto-based. A crypto-currency wallet is used to store, send and receive crypto-currencies and tokens.

Distributed Ledger Technology (DLT) - Distributed ledgers use independent computers to record, share and synchronize transactions in their respective electronic ledgers, instead of keeping data centralized as in a traditional ledger. The most common DLT is the blockchain, which is used as the building block for cryptocurrencies, identification, e-governance, commerce and a growing number of use cases which will likely transform the entire global trade, finance, identity and commerce systems.

Fiat is currency that is considered legal tender and guaranteed by the national government that issues it.

Fourth Industrial Revolution is the current and developing environment in which disruptive technologies and trends such as AI, IoT, robotics, the blockchain and virtual reality are changing the way we live and work.

Impact is a term which can be confusing in a conversation between development professionals and others. For development practitioners, impacts are the long-term effects, positive or negative, intended or unintended of an intervention. For others involved in creating new technologies for social good or focussing on channelling new money into social impact programmes, impact is simply a term used to denote something positive in social or environmental terms. This definition of impact doesn't necessarily measure inputs, outputs, outcomes or impact, and indeed might involve no measurement at all, but rather be used as a blanket term for an initiative which is assumed to have positive social implications.

Impact investment is a term popularised by Judith Rodin and the Rockefeller Foundation in 2007 and now become a very popular term. Most serious definitions of an impact investment involve two critical terms: intentionality; and measurement. In order of an investment to really be an impact investment, the investor should intend to achieve certain social or environmental targets and make it explicit what the targets are. The investor (or intermediary, or external party) then must measure and report on both the commercial return as well as the social or environmental returns as part of routine reports. Many funds, investors and entrepreneurs use the term as a new marketing term to ride on the wave of excitement about the space.

Innovative finance can mean different things to different people, but most definitions clearly include engaging non-traditional partners, which generally means partners in the private sector, including corporations, the business community, and investors. Innovative finance can include impact investments, public private partnerships, results-based financing mechanisms, outcomes-based contracts, impact bonds, challenge funds, results-based loans, advance market commitments, conditional cash transfers and prizes. More and more, financial technology – or fintech – is playing an important enabling role in innovative financing initiatives.

Institutional Investors pool money to make large-scale investments; they include banks, insurance companies, pensions, hedge funds, investment advisors, and mutual funds.

Investors use their own or other's funds to provide money to enterprises or financial mechanisms with a view to driving social change while at the same time receiving a financial return. This is referred to as a double-bottom line, or where environmental issues are considered, a triple-bottom line. Generally, these investors are known as impact investors, social investors, or social impact investors, although there is a push at various levels for these terms to be dropped so that there is no distinction between these types of investors and mainstream investors.

The internet of things (IoT) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices. The term is closely identified with RFID as the method of communication, although it also may include other sensor technologies, wireless technologies or QR codes.

The IoT is significant because an object that can represent itself digitally becomes something greater than the object by itself. No longer does the object relate just to its user, but it is now connected to surrounding objects and database data. When many objects act in unison, they are known as having “ambient intelligence”.

Regulatory sandboxes are a ‘safe space’ in which businesses can test innovative products, services, business models and delivery mechanisms without immediately incurring all the normal regulatory consequences of engaging in the activity in question.

Machine learning focuses on learning and prediction, while artificial intelligence applications often create, plan, or do something in the real world. For example, a machine learning model might be used to predict driving time between two places. An artificial intelligence application would plan routes and drive the car.

Maker's Culture an approach built on the notion that learning is best done through doing.

The **Outcome Funder** in a results-based financing mechanism - also referred to in different contexts as the Commissioner or Outcome Buyer – is the government, donor, or foundation that identifies the social challenge, models out potential savings, proposes the outcome metrics, and then agrees to pay for the outcomes when the targets are met.

Permissioned blockchains ‘maintain an access control layer to allow certain actions to be performed only by certain identifiable participants. These blockchains differ from public as well as private blockchains’ (Investopedia).

A **platform** is a group of technologies that are used as a base upon which other applications, processes or technologies are developed.

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object. In current development usage, the term “remote sensing” generally refers to the use of satellite- or drone-based sensor technologies to detect and classify objects on Earth.

A **retail investor** is an individual who invests for his or her own personal account rather than for an organization. Retail investors typically trade in much smaller amounts than institutional investors.

Self-sovereign identity refers to a digital identity that is under the complete control of the individual whose identity it is – it can't be impersonated or deleted and it can't be used without the individual's explicit permission. It has been made possible by DLT's decentralised, secure, timestamping technology.

Tokens a unit of value issued by a tech or crypto start-up, intended to be a piece in the ecosystem of their technology platform or project.

In a pay-for-success financing mechanism, where payment is determined by the achievement of pre-agreed outcome metric targets, it is essential that results are **verified** in order to trigger payments. As substantial amounts of money are involved, it is essential that all parties have the highest degree of trust in the impartiality and accuracy of how the results are verified.

Results-based Financing Structures have a reasonable degree of confusion around their commonly used terms. In the United Kingdom, where the mechanism was first deployed, they are known as Social Impact Bonds, or SIBs. This is the most common term in Continental Europe as well. In Australia they're called Social Benefit Bonds (SBBs), and in the United States of America, they're known as Pay-for-Success Bonds. They are often referred to as Development Impact Bonds, or DIBs, in emerging economies.

The reality is that they are not bond instruments as described above. And they don't pay based on the achievement of impact as development practitioners know it. And a pay-for-success financing deal can be launched in an emerging economy without the characteristics of what most of the global community refer to as a Development Impact Bond.

More accurately, they are agreements whereby private investors provide upfront risk capital for the delivery of social services by service providers, and the investors are repaid with a success premium by an outcome funder if the pre-agreed targets are met. These mechanisms have involved from outcomes-based and pay-for-results contracts.

In broad terms, a SIB, SBB or Pay-for-Success Bond involves a government entity as the outcome funder; the difference between these and a DIB is that a DIB involves a third-party – such as a donor, corporation or foundation – ie not the host government – commissioning or paying for the outcomes. It is entirely feasible for a results-based financing mechanism to be structured in an emerging economy with the host government as the Outcome Funder.

The **Finance-to-Results-to-Payment Cycle** is specific to the mechanisms outlined above. It is every step in the chain from the provision of the upfront working capital, to the use of these funds to deliver activities, to the monitoring and measurement of the results, to the verification of the results, to the use of the verified data triggering payments.

Smart Contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. The code and the agreements contained therein exist across a distributed, decentralized blockchain network. Smart contracts permit trusted transactions and agreements to be carried out among disparate, anonymous parties without the need for a central authority, legal system, or external enforcement mechanism. They render transactions traceable, transparent, and irreversible (Investopedia, 2018).

The **Theory of Change** is a schema describing and illustrating how a set of activities, or inputs, will contribute to the outputs that lead to the desired social outcome of a development program, and eventually the impact that is expected. The Theory of Change is a powerful tool for Outcome Funders and Investors or Intermediaries to utilise when negotiating the outcome metrics in a pay-for-success financing mechanism.

Web 3.0 is an evolution of the technology of the internet, whereby like an artificial intelligence assistant, user interactions with websites are personalised based on the understanding of the user.

ANNEX 2 LIST OF ACTORS CONSULTED

Investors

Erika Wiese – Head of Portfolio Management, Innovation Edge

Sietse Wouters and Anita Kover – Program Manager Social Finance and Project Manager Social Finance, UBS Optimus Foundation

Enrique Alvarado Hablutzel – Fund Manager, Bamboo Capital

Experts

Aunnie Patton Power – CEO, Intelligent Impact

Jane Thomason – CEO, Blockchain Quantum Impact

Tom Adams – Chief Impact Officer, Acumen

Stephen Ladek – Director, IMC USA

Mara Airoidi and Laura Quiroz Lopez – Director and Research Assistant, Government Outcomes Lab at the Blavatnik School of Government

Donors

Craig Jolley and Aubra Anthony – Senior Data Scientist and Strategy & Research Lead, USAID

Jessica Cartwright – Programme Manager for Private Sector Department, DFID

Seb Mhatre – Technology and Innovation Adviser, DFID

Marco Gerritsen – Development Expert, Embassy of the Kingdom of the Netherlands in Ethiopia

Multilateral Organisations

Nadia F. Piffaretti – Senior Economist, Financing Solutions, Strategy and Analytics, World Bank Group

Elina Jarvela – Senior Innovative Finance Adviser, UNDP

Marina Petrovic – Alternative Finance Expert, UNDP Istanbul Regional Hub

Marina Krawczyk – Manager, Financial Innovation Lab, Global Philanthropy, PFP, UNICEF

Mohamed El-Habib Chenguiti Ansari – Lead Strategist, Strategic Transformation Department, Islamic Development Bank

Hila Cohen, International Business Development Lead, Innovation Accelerator at World Food Programme

Service Providers

Juan Luis Coderque Galligo – Head of New Financing Models, ICRC

Applications

Chinyere Nnadi – CEO, Sela Labs

Raphael Mazet – CEO, Alice.si

Manjula Lee and John-Paul Hamilton – CEO and Partnerships Director, World Wide Generation

Shaun Conway – CEO & Founder, ixo Foundation

Julian Circo – Co-Founder & CEO, Proof of Impact

James L. Sisneros – Founder, Zaahah & the aHa digital currency

Roi Abraham and Ariel Lashansky – The Healthiest Village

Will Ruddick – Founder & Director, Grassroots Economics

Tat Lam – CEO, Shanzhai City Holdings Limited

Scott Hartop – Scout Impact

Richard Flemmings – Operations Director, TCarta

Other

James Montgomery – Innovation in Development Independent Consultant

Reema Rustagi – Senior Data Scientist, QED Group

ANNEX 3 CATALOG OF USE CASES

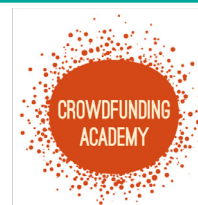
Name: Alice
Geographic focus: GLOBAL
Type of tech: DLT
Date started: May 2016
Stage: Live product
Link: <https://alice.si/>



Alice is a social funding network that allows funders to track their impact in real time with automated reporting and monitoring for charities, NGOs and social enterprises. Built on the Ethereum blockchain, Alice brings together philanthropic funders, impact investors, M&E professionals and beneficiaries, using smart contract-based incentives to ensure that projects are run transparently, that impact data is independently verified and transaction costs are streamlined.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Global pioneer: first blockchain network to launch PbR projects in real world conditions - Extensive technical and operational expertise - Compliant with UK Charities Act - Regulated stablecoins - Extensive network of partners 	<ul style="list-style-type: none"> - Not scaled - Not currently integrated with any other technology to streamline verification 	<ul style="list-style-type: none"> - Once compliant, will be open to all classes of investors - Potential to massively scale donations from public which could be used as outcome funds 	<ul style="list-style-type: none"> - Competitive market - Model relies on ensuring compliance with specific regulatory environments which take time to understand and comply with

Name: The Crowdfunding Academy
Geographic focus: GLOBAL
Type of tech: Crowdfunding through web platform
Date started: February 2017
Stage: Completion
Link: <http://altfinlab.org/blog/crowdfunding-academy-ukraine-2017>



UNDP's AltFinLab, an internal startup run out of the UNDP Istanbul Regional Hub for Europe and CIS, has run 10 Crowdfunding Academies globally. Crowdfunding Academies are 3-6 month initiatives where the team identifies a pipeline of potential ideas, develops ideas into a crowdfunding campaign and provides hands-on support during the campaign. The team is moving into the area of setting regional support centers with the best candidates by providing education, training and by connecting local actors, diaspora, start-up community, and social enterprises.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Simple - Crowdfunding backed by UNDP increases trust factor - A non-formal educational programme on developing crowdfunding campaigns 	<ul style="list-style-type: none"> - Currently limited only to 12 ideas per year - Not sustainable. Crowdfunding is usually a one time affair. It is difficult to repeat the process many times. 	<ul style="list-style-type: none"> - Can be replicated across geographic locations to bring out ideas from entrepreneurs in hard to reach areas - Good starting point cooperatives / start-up / cities / municipalities 	<ul style="list-style-type: none"> - Ongoing funding support - Credibility issue

Name: Grassroot Economics & Africa's Healthiest Village
Geographic focus: Kenya and South Africa
Type of tech: DLT with cryptocurrency (Bancor protocol, POA.network public Ethereum sidechain)
Date started: November 2018
Stage: Implementation in Kenya and Planning for South Africa
Link: <https://www.bloomberg.com/news/features/2018-10-31/closing-the-cash-gap-with-cryptocurrency>



Grassroots Economics is a non-profit foundation, focused on community development through economic empowerment and community currency programs using the [Bancor](#) protocol. The Liquid Community Currency is a locally run community currency based on Bancor protocol and the POA.network blockchain. The project, Africa's Healthiest Village, aims to create a confederation of interconnected regional hubs through the introduction of an Liquid Community Currency in the Former Transkei Region of South Africa.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Community originated and based program built on technology - Bancor protocol allows for interaction and exchange of different digital currencies using a smart contract - Allows local market to thrive based on its productivity 	<ul style="list-style-type: none"> - Currently only tradable in the Sarafu network and not to other cryptocurrencies or traditional forms of currency 	<ul style="list-style-type: none"> - Allows for a community to trade with other communities based on their productivities - Opportunity to build a financial system that looks to be a non-profit 	<ul style="list-style-type: none"> - Political instability - Reliance on telecoms for internet-less transactions

Name: ICRC Humanitarian Impact Bond
Geographic focus: Nigeria, Mali and Democratic Republic of Congo
Type of tech: Digital Centre Management System (database)
Date started: September 2017
Stage: Launched



ICRC

<https://www.icrc.org/en/document/worlds-first-humanitarian-impact-bond-launched-transform-financing-aid-conflict-hit>
<https://golab.bsg.ox.ac.uk/knowledge/case-studies/humanitarian-impact-bond/pdf/>

The ICRC Humanitarian Impact Bond aims to raise 26 million Swiss francs (\$27.3 million) to build and operate three physical rehabilitation centers in conflict-affected parts of Africa over the next five years. The capital raised – 26 million CHF – will be used to build and run three new physical rehabilitation centres in Africa (Nigeria, Mali and Democratic Republic of Congo) over a five year period, providing services for thousands of people. The payment-by-results programme also includes the necessary training for the new staff as well as the testing and implementation of new efficiency initiatives.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Centre management system to improve efficiency while generating quality outcomes - Up to 40% of investor capital is at risk - ICRC is taking a first loss position demonstrating confidence by putting 'skin in the game'. 	<ul style="list-style-type: none"> - Part payments based on construction of centres ie outputs as opposed to outcomes 	<ul style="list-style-type: none"> - The centre management system could help ICRC increase efficiency across all 100 centres 	<ul style="list-style-type: none"> - If results are not reached, the investors will lose some of their capital however the activities will not cease as ICRC will take up the funding using core funding and grants potentially impacting other activities

Name: IDinsight, Machine Learning Team

Geographic focus: Asia + Africa

Type of tech: Machine Learning

Date started: 2017

Stage: Initial pilot complete, planning scale

Link: <https://www.idinsight.org/> | https://ssir.org/articles/entry/can_machine_learning_double_your_social_impact



IDinsight is building a machine learning practice to help NGOs and governments better use these techniques to maximize their social impact. In their first project, IDinsight partnered with Educate Girls, an education NGO in India, to use machine learning to drastically improve Educate Girls efficiency (50%+). By helping predict where large numbers of out of school girls were located, IDinsight helped Educate Girls target their program expansion. IDinsight believes there are many related applications in health, agriculture, energy, and other sectors that could use machine learning to improve lives.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Machine learning can make operations drastically more efficient through targeting resources or informing preventative action - Automation allows reproducibility and consistency across programs, enabling scale 	<ul style="list-style-type: none"> - Large, accurate datasets required to train and deploy machine learning algorithm - Only relevant for "prediction questions" 	<ul style="list-style-type: none"> - Potential to inform decisions at a very large scale - Opportunities to use novel, large datasets such as cell-phone data and satellite imagery data. 	<ul style="list-style-type: none"> - If not done carefully, machine learning algorithms can introduce or perpetuate biases that exist in society. - There may be political resistance to automating decisions with algorithms

Name: IDinsight, Data on Demand

Geographic focus: Asia + Africa

Type of tech: Machine Learning

Date started: 2017

Stage: Scaling

Link: <https://www.idinsight.org/>



IDinsight is working to revolutionize survey data collection with the goal of reducing the cost and time of a nationally representative survey by an order of magnitude. Among other innovations, IDinsight is deploying machine learning in two ways to boost efficiency. One is to use satellite imagery and machine learning to identify all households to build a sampling frame, which allows surveyors to be deployed immediately. The other is developing a machine learning algorithm to flag low quality survey work, which reduces the middle management layer and makes the data collection infrastructure more scalable.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Once the Data on Demand infrastructure is deployed at scale the cost and time to conduct high quality household and facility surveys will be drastically lower 	<ul style="list-style-type: none"> - Building the infrastructure nationwide requires significant upfront expense, and sufficient demand to maintain it 	<ul style="list-style-type: none"> - Results verification will be more accurate, faster and cheaper than ever before, even in remote areas of the developing world 	<ul style="list-style-type: none"> - Eventually this infrastructure will need to be replaced by newer technology, especially when the vast majority of the poorest households have mobile phones, electricity and internet



Name: Quality Education India Development Impact Bond
Geographic focus: India (ASIA)
Type of tech: ixo token
Date started: Quality Education Impact Bond – Planned for 2019
Stage: Pilot completed, scaling up
Link: <http://www.qualityeducationindiadib.com/>

The Quality Education India DIB builds on the success of the pilot DIB with Educate Girls that ran from 2015-17, focused on improved performance in English, Hindi and Mathematics for girls. Alongside the verification agency Gray Matters, ixo will be piloting putting a small number of schools on the ixo platform; educators will register children using a smartphone app and self-sovereign digital identifiers.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - ixo platform should allow existing DIB instruments to be converted into smart impact bonds that allow – Automation, replication, optimisation, efficiency and be cost-effective 	<ul style="list-style-type: none"> - Currently un-tested - Small pilot 	<ul style="list-style-type: none"> - Convert learning outcomes into tradable units or tokens - Creation of marketplace where learning outcomes can be traded 	<ul style="list-style-type: none"> - Independence of evaluators is essential for credibility - Commercial model unproven



Name: Amply
Geographic focus: South Africa (AFRICA)
Type of tech: Mobile application, DLT
Date started: 2015
Stage: Second Pilot (2018)

Link: <http://www.amply.tech/>
<https://www.connectingup.org/sites/default/files/ch/ch/Socialsuite%20Deck%20-%20IXO.pdf>

Amply is a mobile DApp for taking attendance in schools, that was introduced to replace an existing paper-based system in government funded early childhood schools in South Africa. The pilot demonstrated that attendance claims could be registered in DLT. The second pilot focused on connecting unregistered centres with external funding, and improving the usability of the app. The first project internationally to use self-sovereign digital identifiers.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Simple solution that resolved a financing (subsidy) issue between providers and funders through a technology-based verification - Sustained multi-year pilot, leading to expansion - Able to detect and exclude many duplicated or false claims compared with the legacy paper-based system 	<ul style="list-style-type: none"> - Does not include the financial transaction capability to automatically pay service providers 	<ul style="list-style-type: none"> - Demonstrate lower administration costs - Expanding recorded data beyond attendance, to create payments for results for other outcomes 	<ul style="list-style-type: none"> - Depends on the government subsidy program - Commercial model unproven

Name: Reforestation in Madagascar with Seneca Zoo
Geographic focus: Madagascar (AFRICA)
Type of tech: DLT, Remote and physical sensing methods, satellite imagery
Date started: May 2018
Stage: Proof Of Concept
Link: <https://www.itweb.co.za/content/Pero3qZg2orvQb6m>



The first collaboration between the ixo Foundation and the Seneca Park Zoo Society, which is based in upstate New York, will be used to record insect and animal life regeneration in Madagascar reforestation. Communities are rewarded with tokens into community wallets based on their ability to maintain the regeneration of a forested area. The regeneration is monitored using remote sensing technology, allowing the delivery of tokens to be triggered automatically to communities.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Sensors connected to the ixo blockchain to collect and verify data - Conversion to token allows detailed reports to funders - Proven track record of ixo with Amply 	<ul style="list-style-type: none"> - Capital intensive - Scalability is limited by building relationships with and assessing the credibility of communities to deliver outcomes 	<ul style="list-style-type: none"> - Could potentially bring in new money and investors into the environment impact space - Could turn environment impact actions like planting trees into tradable units or tokens 	<ul style="list-style-type: none"> - Poachers might get hold of the information and be able to find out the location of animals - Morality issues, forest fires could be started on purpose to reduce value of generated tokens

Name: Nexleaf Analytics
Geographic focus: Low- and middle-income countries
Type of tech: Sensors, IoT, web-based analytics
Date started: 2009
Stage: Implementation



Link: <http://nexleaf.org/about-us/>

Nexleaf Analytics builds and deploys cloud-based sensors to support energy efficient products (e.g. clean cookstoves, refrigerators, etc.) that work anywhere in the world and upload data in real time. Web-based dashboards and analytics tools monitor their effectiveness, use and impact. They are partners with Google, the Bill and Melinda Gates Foundation and Qualcomm Wireless Reach.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Nexleaf has been able to quickly evolve and adapt its products to integrate frontier technology effectively for low-resource settings - Nexleaf has the potential to fully complete the results to finance chain 	<ul style="list-style-type: none"> - Uptake and success of Nexleaf's products is highly dependent on the performance of the hardware 	<ul style="list-style-type: none"> - Nexleaf is expanding its product lines to identify other opportunities to deploy sensors - Aligning Nexleaf's products with innovative financing models 	<ul style="list-style-type: none"> - Nexleaf's products needs to remain cost competitive - Mixed messaging around the effectiveness of clean cookstoves

Name: The Utkrisht Impact Bond

Geographic focus: India (ASIA)

Type of tech: Connected tablets uploading to a SQL server with a web interface

Date started: Dec 2017

Stage: Pilot

Link:

https://thepalladiumgroup.com/download?file=AED_1516861800_30130file_upload_convergence_report.pdf%23Convergence+Report.pdf



The Utkrisht Impact Bond will improve the quality of maternal care in Rajasthan's private health facilities by supporting up to 440 Small Healthcare Organizations (SHCOs) to meet new government quality standards and adhere to them over the long term. The impact bond brings together private providers, local government, outcomes-funders, investors and intermediaries. Verification of outcomes happens through tables with a web interface.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - SQL enables program to be data rich - Data assists funders with making an informed choice about price points 	<ul style="list-style-type: none"> - High transaction costs - Needs a champion stakeholder - Not all the interventions are well suited for an impact bond structure 	<ul style="list-style-type: none"> - Use donor funding as a proof of concept for future government funding 	<ul style="list-style-type: none"> - Service providers are immediate competitors - Moving from design to implementation in a timely fashion is challenging

Name : Performance based Token for Output Generation (DGIS, Proof of Impact & Cordaid)

Geographic focus: Ethiopia (AFRICA)

Type of tech: DLT, remote sensors

Date started: late 2018

Stage: Pilot

Link: <https://www.cordaid.org/en/news/towards-balanced-rethinking-performance-based-financing/>
<https://proofofimpact.com/introducing-performance-based-tokens-next-generation-blockchain-powered-performance-based-54e1b39eab6d>



Proof of Impact developed Performance-based-Tokens ("PBTs") with the Ethiopian Government and The Netherlands Ministry of Foreign Affairs for the Ethiopian Health Sector to use blockchain technology to improve tracking and delivery of health impact. The pilot will initially facilitate impact attribution by assigning output tokens to donors, thereafter these outputs can be structures in a "tokenised impact bond" underwritten by the Dutch Government to provide a return for impact investors purchasing these tokens when the overall outcome is achieved.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Connects the results to payment chain - Collaborative approach with government support - Smart contracts allow automatic payments to be triggered between buyer and producer 	<ul style="list-style-type: none"> - Need to build the data management capacity of staff - Not all stakeholders in the ecosystem are equipped to handle NFC sensors and blockchain 	<ul style="list-style-type: none"> - Sensors in medical technology send time stamped proof that a service was delivered - If the impact token is proven it can be applied across sectors 	<ul style="list-style-type: none"> - Long term data storage is expensive - Verification methods need to be tested - Need to demonstrate through the use case that it is cost effective

Name: Tuberculosis Testing and Monitoring

Geographic focus: India

Type of tech: DLT, IoT sensors for biometrics, on Proof of Impact's DApp

Date started: 2019

Stage: Launch



Link: (none)

Proof of Impact is working with the Indian government on creating a patient data management system based on a photograph of the palm of the patient, with a sensor. By integrating across private providers, laboratories, pharmacies, clinics and hospitals, the patients' TB treatment could be tracked without needing to capture personal information.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Targeted at solving a locally identified problem, that is scalable across the country - Integrates various forms of frontier technology - Solves the issue of identity sensitivities of tracking with fingerprints 	<ul style="list-style-type: none"> - Unclear how long integrating and educating staff to use the technology would take 	<ul style="list-style-type: none"> - Potential for quantifiable healthcare impact outcomes - Predictive analysis to track and understand the journey of a TB patient 	<ul style="list-style-type: none"> - Dependent on ongoing government engagement - Preliminary stage project requiring the collaboration of many disparate stakeholder groups

Name: "Verify – Track – Invest – Trade"

SDG Merchant Bank powered by Proof of Impact

Geographic focus: Global

Type of tech: IoT for event verification + digital exchanges for distribution

Date started: 2019

Stage: Scoping

Link: www.proofofimpact.com



Proof of Impact is working with a team establishing the world's first SDG Merchant bank focused initially on Africa to create "bottom-up" Tokenised impact investment Products ("TiiPs") that directly connect outputs and outcomes to funding. These TiiPs become tradeable on regulated digital exchanges such as Lykke in Switzerland and Nxchange in The Netherlands

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Targeted at solving lack of liquid impact investment products - Leveraging off the breakthrough of emerging technologies that can verify SDGs achieved real time - Structuring innovative financial products 	<ul style="list-style-type: none"> - Speed of adoption of emerging technologies at SDG input and verification stage - Investors appetite for holding digital assets 	<ul style="list-style-type: none"> - Potential for an entirely new SDG investment product market - Stepping stone to investing in trading SDGs as natural and social capital (like carbon credits) 	<ul style="list-style-type: none"> - Dependent on various parties coming together with a willingness to innovate - Educating the incumbent investor market to invest in new forms of investment opportunities

Name: Sustainability International project in the Niger Delta
Geographic focus: Nigeria (AFRICA)
Type of tech: DLT
Date started: 2018
Stage: Launch
Link: (none)



This use case focusses on verifying and measuring development projects in the Niger Delta, specifically clean-up operations and affordable housing, which when verified (through community verification agents), get paid from the existing pool of funds available for the purpose.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Targeted at solving a locally identified problem - Brings accountability which is badly needed - Ensures payment only when services are delivered and verified 	<ul style="list-style-type: none"> - Verification currently relies on individual community members - Illiteracy is an issue when communicating with partners 	<ul style="list-style-type: none"> - Use satellite imagery and AI to verify results 	<ul style="list-style-type: none"> - Access to suitably qualified and motivated technical teams

Name: Shanzai City Micro-Impact Bond
Geographic focus: Myanmar
Type of tech: IO2 based DLT
Date started: November 2018
Stage: Proof Of Concept



Link: <https://medium.com/impact-oxygen-foundation/piloting-crowd-consensus-metrics-for-micro-impact-bond-77e56d6afe0c>
<https://medium.com/impact-oxygen-foundation/building-blocks-for-smart-impact-bonds-in-developing-regions-crowd-validation-consensus-metrics-f9e464abddf6>

A "Crowd Consensus Metrics" based community playground project bond in Yangon Myanmar using a Smart Micro Impact Bond. The model involves the better-off members of the community pledging funds for community-voted projects in exchange for a small % financial return. The community bond holders are repaid by the government when the project is completed.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - IO2 protocol for crowd due diligence, crowd census, crowd impact measurement and proof of participation token. - Increases community engagement and inclusivity 	<ul style="list-style-type: none"> - So far pilots have used paper tokens only - Local community members are not guaranteed repayment, making them vulnerable 	<ul style="list-style-type: none"> - Connect international funders with community need driven projects - Significantly lower structuring costs than international DIBs 	<ul style="list-style-type: none"> - Lack of system through which to engage external funders might limit scalability - Token may be limited to only a certain part of the society

Name: Pay-for-success Education Smart Contracts
Geographic focus: Myanmar
Type of tech: DLT, iO2 based Pay for Success Tokens
Date started: Planned 2019
Stage: Ideation



Link: <https://medium.com/impact-oxygen-foundation/pay-for-success-p4s-smart-contracts-can-secure-education-opportunities-for-children-in-myanmar-a09c161d045>

Individual-level pay for success scholarship smart contracts, by iO2 Foundation and community organisation Connecting Myanmar. A scholarship contract with university students, which payment is insured when certain milestones related to learning progress and career planning are accomplished; when new payment conditions are proposed by the donor(s), there will be a "dispute resolution" platform that allows both parties to negotiate and discuss for mandate amendments.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Pay for Success smart contracts where payment is released on completing certain milestones - Helps donors track progress of students and create new milestones 	<ul style="list-style-type: none"> - Unclear how success is measured and how reporting happens - Does not address students who have dropped out 	<ul style="list-style-type: none"> - Setting up own scholarships or student loans - Partnering with outcome agencies that are willing to clear loans of students who return to work in their communities 	<ul style="list-style-type: none"> - Competition with other education loan providers - Vulnerability of loans directly to students, legislative issues are possible

Name: SolarCoin
Geographic focus: Global
Type of tech: DLT-based digital token
Date started: 2014
Stage: Operational



Link: <https://cleantechnica.com/2017/06/29/solarcoin-cryptocurrency-earned-generating-solar-electricity/>
https://solarcoin.org/wp-content/uploads/SolarCoin_Policy_Paper_EN-1.pdf

SolarCoin is a reward for solar energy producers. The SolarCoin Foundation rewards solar energy producers with blockchain-based digital tokens at the rate of one SolarCoin (SLR) per Megawatt-Hour (MWh) of solar energy produced. Since 2014, the SolarCoin Foundation has granted to solar installations who have produced a collective 11 terawatt-hours (TWh), enough to power 11 million American homes for a month. It is present in 71 out of 215 countries.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Incentivises solar generators of all sizes (need to have proof of installed power plant) - National governments are backing SolarCoin and exchanging it for fiat currency - Scalable solution 	<ul style="list-style-type: none"> - Low adoption rate - Aimed value \$30 currently at around ~\$0.02 - The need to convince power producers to provide generation data is a challenge - Undiscovered (unknown) market - Need to have e-wallet 	<ul style="list-style-type: none"> - Large scale generators adopting the SolarCoin could catalyse further adoption of SolarCoin - Increased partnership and publicisation to get buy-in from more stakeholders - Good for CF platform to offer investors when launching PV plant 	<ul style="list-style-type: none"> - Ecosystem and technology barriers in scaling up its adoption to become a mainstream alternative currency - Not being able to leverage social added value versus other cryptocurrencies

Name: TCarta
Geographic focus: Global
Type of tech: Satellite imagery
Date started: 2008
Stage: Operational
Link: <https://www.tcarta.com/who-we-are>



TCarta is a provider of innovative geospatial products and earth observation analysis services. With a history of successfully delivering solutions in a variety of applications, including environmental monitoring, TCarta's primary focus is on providing affordability and accessibility of satellite data and analytics utilizing cutting edge technology and approaches. TCarta have consistently bridged the gap between research and development, and deployable end uses of satellite derived data and information.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Enables large scale mapping and analysis; - Technology deployable remotely, allowing consistent results without a need for local access; - Technology adaptable to a wide variety of end uses; - Experienced team of technical experts and project delivery. - Multiple uses and sector agnostic 	<ul style="list-style-type: none"> - Currently no linkage to results; - New technology often requires stakeholder persuasion prior to deployment, increasing lead times. 	<ul style="list-style-type: none"> - By partnering with others eg Proof of Impact, could link satellite imagery and analysis to results; - Cost of satellite imagery decreasing, and imagery availability increasing; - Potential to link to carbon emissions. - Favourable access to major data/hi-res image banks (DigitalGlobe) - Seabed mapping. 	<ul style="list-style-type: none"> - Democratization of access to imagery may crowd the market with cheaper but fit-for-purpose solutions.

Name: Cash Transfers for Syrian refugees using Building Blocks
Geographic focus: Jordan (MENA)
Type of tech: DLT
Date started: 2017
Stage: Trial completed, piloting at much larger scale planned for 2019
Link:



<https://www.coindesk.com/united-nations-sends-aid-to-10000-syrian-refugees-using-ethereum-blockchain/>
<https://www.technologyreview.com/s/610806/inside-the-jordan-refugee-camp-that-runs-on-blockchain/>

WFP used Ethereum Parity with Proof of Authority to direct token-based vouchers to thousands of Syrian refugees, to be redeemed at the supermarkets inside the refugee camps. Over 10,000 individuals' transfer were authenticated in the initial pilot. The project is now providing assistance to 106,000 refugees in the Azraq and Zaatar camps, with plans to scale up support to all 500,000 refugees WFP serves in Jordan.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Blockchain has reduced the transaction cost from 1.5% to a negligible 0.003%. - Proven Iris scan technology helps include people without government IDs - Increase physical security due to lack of physical vouchers - Reduced chance of fraud 	<ul style="list-style-type: none"> - Runs on permissioned blockchain which lets WFP write new transactions if there are inconsistencies - Vouchers can only be redeemed for cash or goods at supermarkets inside the refugee camps 	<ul style="list-style-type: none"> - Proven model could lead to a digital ID where beneficiaries own and control their data - Could expand to work with land ownership, educational credentials etc at an evolved stage 	<ul style="list-style-type: none"> - A permissioned blockchain could technically be replaced by a database - Data security, as biometric data is involved; while WFP holds no data, security threats exists with the communication between IrisGuard and the EyeCloud database.

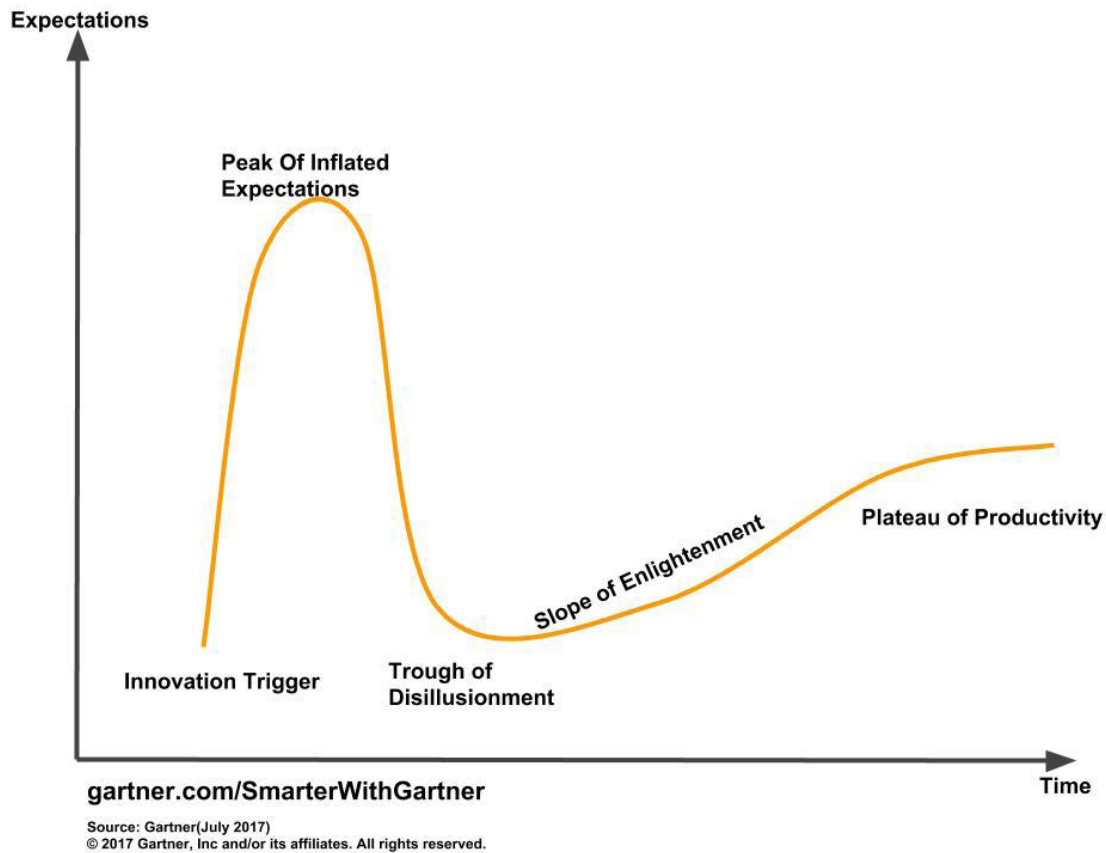
Name: The G17Eco Platform
Geographic focus: Global
Type of tech: DLT
Date started: 2017
Stage: Building Ecosystem
Link: <https://www.worldwidegeneration.co/>



WWG developed G17Eco to deliver real time monitoring, reporting and verification (MRV) of the financial and impact performance of any type of investment or initiative across any sector, while aligning the performance with the framework of the SDGs. This insight should enable organizations to more actively manage their activities, increase their effectiveness, reduce risk and enable increased funding and partnership creation.

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> - Caters to different actor groupings across the impact landscape - Focusses on measurement and verification of results - Strong political and financial support 	<ul style="list-style-type: none"> - Full capability may not be required by all clients - Verification still currently relies on human input 	<ul style="list-style-type: none"> - Potential for massive scale - Universal trackers could make verification much easier 	<ul style="list-style-type: none"> - Needs to be focussed on key target clients to gain traction and maintain positive momentum

ANNEX 4 GARTNER HYPE CYCLE



Each Gartner Hype Cycle drills down into the five key phases of a technology's lifecycle.

- **Innovation Trigger:** A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist, and viability is unproven.
- **Peak of Inflated Expectations:** Early publicity produces several success stories — often accompanied by scores of failures.
- **Trough of Disillusionment:** Interest wanes as experiments and implementations fail to deliver. Producers of the technology shake out or fail. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters.
- **Slope of Enlightenment:** More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious.
- **Plateau of Productivity:** Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broader applicability and relevance are clearly paying off.