April 5, 2021

Request for Information Number: 1 -20210517, 2 – 20210518 and #-20210519
Issue date: April 5, 2021
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Introduction: Tripartite Request for Information for Financial Inclusion for Small-scale Farmers

To Whom It May Concern:

Heifer International has selected you as a possible vendor for designing and assisting in successfully implementing the Heifer's Land Registry for Financial Inclusion for Small-scale Farmers.

The Request for Information (RFI) is a method to describe the software, products, and services Heifer is seeking to create a Land Registry platform as well as risk and behavioral economic tools to provide low-cost financial assistance to small-scale farmers. Through this RFI, Heifer expects to develop and implement a prototype solution in Heifer Malawi and Heifer Honduras.

Please read this document in its entirety before proceeding**. The closing date and time is 23:59, May 17, 2021.** The last date to submit questions and the Letter of Intent is May 3. There are instructions in this document. We thank you in advance for your participation in this landmark project.

We look forward to working with you to complete this endeavor.

If you have questions regarding this RFI please contact:
Heifer International

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Framework for Financial Inclusion for Small-scale Farmer

Aim: Secure $1billion fund to enable land ownership, financial inclusion, and sustainable farming practices for small-scale farmers worldwide
Terms: Throughout this document, the terms small-scale and smallholder are used interchangeably to describe farmers. We adhere to the UN definition of small-scale or smallholder farms as land plots of 2 hectares or less, roughly 5 acres.

Capacity Building and Financial Inclusion for Small-scale Farmers:

The Challenge and Opportunity:
Land is a poor person's primary asset. Most of the 570 million small-scale farmers in developing countries do not own their land – they are tenants, occupants, or have other types of use rights. Moreover, even for those with ownership rights, their land rights are often informal and can be insecure because rights have not been documented yet or because documentation has fallen out of date and uncoordinated with reality on the ground. The lack of ownership and adequate documentation, meaning registered title (or equivalent context-relevant document), is one of the key elements that deprive individuals of accumulating wealth and genuine financial inclusion.

Small-scale farmers, most of who are tenant farmers or farmers with informal land rights, produce 13-30 percent of the gross domestic product of any given developing country. Specifically, the agriculture sector in Malawi accounts for 28.1 percent of GDP and 13.8 percent in Honduras (CIA World Fact Book, 2019). Tenant farmers and smallholders without formal land documents are often ghosts in the financial machine:

- They do not exist in revenue records: informal receipts of purchase, inheritance, or allocation are not typically sufficient for lender requirements. Leases may not be recorded and the absence of transparency in deals with landlords often results in exorbitant and unreasonable payouts in cash and kind.
- Lease agreements are often subject to arbitrary decisions of governments; often periods of leases are insufficient to meet the standards of financial institutions or to pass on to the next generation.
- They lack credit flow or working capital and are often ineligible for crop insurance as banks lend to landowners, typically those with documented/titled land. Less than 3% of total bank deposits are available for farm credit, which is provided to qualified borrowers.
- Doors to almost all institutional finance are shut to these farmers; money lenders, landlords, informal markets and micro-finance institutions charge high-interest rates (up to 36 percent) and land rent in the form of sharecropping can run 40-50 percent of the crop.

In India for example, 30-60 percent of farmers in major rice-growing regions are tenant farms, including sharecropping. Conditions of tenant farming are so challenging that 80 percent of the annual 10,000+ farmer suicides are tenant farmers. While the adversity of

tenant farming differs by country, economic region, availability of land, landlord ethics, and crop, what is certain is that tenant farming is a financial dead-end for farmers.

In Honduras, land tenure constitutes a fundamental element of the political and economic debate. Traditionally, the issue of access and distribution of property and security of land tenure has been immersed in complex social and economic circumstances. The current land registry system was established in 1974 by decree 171, culminating 50 years of property rights conflicts. Local property rights, for the most part, are customary or informal. Inconsistencies between state law and local property rights continue to drive disputes related to inheritance, sales, purchase, boundaries right away, falsified deeds, stolen papers, and land grabbing. While women have property rights by decree, in practice, men dominate in title and possession. At present, after two decades of the end of the adjustment policies and after the global international political division's disappearance, it seems that the issues around the land problem have undergone some changes.

A customary land tenure system is common in Malawi and it forms the bulk of land ownership. Most smallholder farmers access the land they use for agricultural production activities via this system. Most land in the customary land tenure system is not registered and therefore the ownership of this land has not been especially useful for accessing capital which in turn limits agricultural investment. However, with the coming of the new Land Act (2016), a process for the registration of customary estates has been created and it defines the customary estates as private land.

Capacity Building:
Capacity building is divided into three parts: Advisory capacity (A), which includes agricultural expertise, farm management, land documentation, and registration process guidance; Financial capacity (F), which includes sustainable financial mechanisms, loans, grants, loan guarantees, monetary plan, fiscal management, risk management & controls and Technical capacity (T), which includes delivery of technology, systems, training and reinforcement to increase sustainability and yields. The total capacity per region and farm is a total of available and applied Advisory, Financial and Technical (AFT) capacity. The operative rule here is: the greater the capacity for delivery of AFT capacity and utilization by individual farmers, the greater the opportunity for successful farming and genuine financial inclusion.

Building financial inclusion capacity for small farmers means promoting practices that enable small-scale farmers to own their land and borrow monies needed to farm adequately to produce income that will sustain their families and provide surplus earnings to bank. Borrowing for land purchase and working capital needs to be at interest rates and timeframes that are commensurate with the challenges and gross margins of farm management and crop production.

Genuine Financial Inclusion:
For small-scale farmers genuine financial inclusion means formally owning land (legal, social and economic practices), gaining access to affordable credit, generating cash flow

beyond subsistence and accumulating wealth that can be transferred between generations. While the normative definition of financial inclusion put forward by the World Bank, an individual identity having access to open a bank account is necessary, is not sufficient to address or elevate poverty. Opening a bank account for these farmers, as a measure of stake holding, is a weak measurement of financial inclusion.

Genuine financial inclusion for small-scale farmers is an ecosystem that includes the five interrelated elements listed below. These five elements form an axis of impact, a holistic way of creating financial inclusion, wealth and sustainability for small-scale farmers:

1. Formal (or documented) Land ownership/rights.
2. Availability of credit for working capital at affordable rates & time.
3. Application of agricultural science and inputs necessary to increase productivity and sustainability over time.
4. Access to storage and markets to generate surplus.
5. Rewards for farm practices that generate sustainability.

Farmers, in some situations, were given title to land by the government but lacked access to working capital (credit), training and critical inputs such as pest control. In Malawi, for example, such was the case of cotton farmers in the South and the results were predictably dire. Furthermore, an unfortunate attribution of failure occurs, land ownership makes no difference to successful outcomes. More accurately, land ownership is necessary, but not sufficient to successful outcomes.

Question of Ownership:
Ownership of land, in our case farms, can occur in many ways. However, we are concerned with primarily two: (1) fee simple and (2) leaseholds. In fee simple, a buyer purchases property outright and has the right to use the property indefinitely. The improvements to the land always remain with the owner and in turn supports the commitment of labor, long-duration investments and sustainable farming. Value creation is attributable to the owner and property.

Leaseholds are properties where an owner (lessor) leases land to buyers (lessees) for a specific time period. There are five potential risks with leased land: (1) the land declines in value over time as time runs out on the lease, (2) the lease rate may dramatically increase as the renewal date approaches to negotiate extending the lease, (3) the lessee may lose the property at the end of the lease (many such cases in Oahu, Hawaii), (4) property may be difficult to value because the primary concern is the length of the lease, not simply the improvements and cash flow generated by the land and (5) there may be financial restrictions on lenders lending money against leased land.

For these reasons alone, we support individual ownership. However, as a fallback, leases that are a minimum of 50 years, with roll over to 99 years would be acceptable if they include covenants on pre-determined price increases and automatic renewal clauses.

Sustainable Finance:

Sustainable finance represents an alternative theory of finance, alternative to the traditional financial paradigm of multiplying profits at any cost. In farming, the traditional financial paradigm translates into monocrops. Which require high inputs (chemicals and water) to drive higher outputs, with little or no regard for impact on farmers, soil or the environment. The true costs of negative impacts are not considered or are hidden.

Sustainable finance is a disciple and practice with over 30 years of applications that can help (a) ensure efficient capital transfer in the economy, (b) prescribe an inherent three-dimensional view of financial practices; economic, environmental, social & governance, (c) provide financial mechanisms that enrich the human and bio-capacity of farms and regions while generating yields and return on capital and (d) reduces financial risk by avoiding environmental degradation or the hidden costs of 'negative externalities' like soil degradation, waste of water & other resources and the poisonous effects of chemicals on humans, soils, and water resources. Sustainable finance will be used to inform our economic, agricultural, and technological program, improving the lives of small-scale farmers.

Title to land combined with capacity building and financial inclusion enable:

1. Land purchase and infrastructure: enables lower payment amount and better terms in relation to cost of land, land documentation processes, infrastructure necessary to succeed, and ability to repay loans. When combined with grants generated by the productivity of crops or in some cases off farm activities farmers have a path to financial independence. For example: loan terms of land purchase might be 5-7 years, 2-3% interest and coupled with a 25% partial grant for purchase; adjusted payments for default crop year (crop measured by satellite bio-mass or weather conditions); infrastructure costs like drip irrigation or solar power package for pumping water could be included in the land purchase as a package necessary to succeed. These land improvements will immediately increase value of the land and potential to drive yield, increasing likelihood of repayment of loans. This includes payments to pay for the cost of land title itself, something governments would support. payments to pay for the cost of land title itself, something governments would support.
2. Working capital: terms for working capital or inputs financing (fertilizer, seeds, etc.) based on seasonal term of crop. For example: 10 percent interest rate ; potential bonus of 2% on crop bounty (measured by satellite/sales); insurance for crops to be amortized as part of the deal.
3. Training: agronomist lead training and support services. Access to crop data and other information to succeed.
4. Incentives: participating in financial inclusion and sustainable practices earns tokens / coins. It pays to farm right.

Conclusion:

Capacity building and financial inclusion are interlinked, one without the other invites failure and the inability to meet the UN Sustainable Development Goals 2030. Our ability to deliver Advisory, Financial and Technical capacity including land ownership and

documentation processes, infrastructure and working capital is necessary for small-scale farmers to join the financial community in their country of origin, commensurate with their contribution to GDP and feeding populations. In addition, we can innovate in sustainable finance. Laying the groundwork for a more efficient and logical application of finance and financial mechanisms to solve real world problems, all the while keeping with real costs and the best of environmental and agricultural science.

RFI #1-20210517 Land Registry Utilizing Blockchain Technology

REQUEST FOR INFORMATION:
Land registry utilizing blockchain technology; immutable documentation of title and land ownership, private parcel and customary (community) title.

LAND REGISTRY SOLUTION: Accessible and Reliable Recordation of Land Rights, Transfers and Encumbrances

The purpose of this document is to solicit information from prospective bidders about the scope of work presented herein and the ability of bidder and marketplace to develop it in a timely manner. This RFI (Request for Information) will be used to assess issues such as project capacity, technical abilities and solutions, cost parameters, and timing of delivery, providing information to move to the next step of creating a Request for Proposal.

This RFI addresses the scope of work for potential technology partners to develop a land registry solution utilizing blockchain. While the land registry solution is a stand-alone piece in terms of project parameters, complexity, technical specifications, development time and cost, it is part of a package of solutions that will be offered to small-scale farmers.

Additional technology solutions include: (1) small-scale farmer access to finance, including a behavioral change component, (2) risk management and resilience tool for farmer and service provider (s), for example, an insurance company and (3) additional tools to enhance small farmer participation in global supply chains e.g., for Cacao**.**

Technology solutions comprise a suite of tools that will make viable the results of on-the-ground activities of Heifer in Honduras and Malawi, which are beta sites. Specifically, tools will be developed in conjunction with Heifer working with participating farmers, local organizations and other partners. These activities might include documentation of land rights, engaging the National Agrarian Institute in Honduras to title lands of farmers belonging to a Cacao cooperative and the Ministry of Lands in Malawi.

The essential elements necessary to deliver information and specifications required to execute the land registry solution are highlighted below. The land registry solution will be designed and bid as a stand-alone technology but planning for interface connections with the other components must be addressed. This includes interoperability with the existing systems for land governance which includes the Land Information Management System for the case of Malawi.

However, opportunities are open to provide information and technical specifications on two additional pieces of the tripartite development package that includes solutions for (a) financial and behavioral platform, and (b) risk assessment tool. While documents will be circulated separately, a request for additional documents to provide information on (a) and (b) will be considered.

Both (a) and (b) above are covered by the following RFI's [add links here] and are referenced below in this RFI. Issues such as cognitive design, interoperability, security and privacy overlap functions and can be generalized across projects to save time and money. Each RFI will be addressed separately, requiring a specific field of applied knowledge, and technical expertise.

The land registry solution, while structurally and technically the same will differ significantly in application to the two pilot countries, Honduras and Malawi. The solution must be configurable or differentiated accordingly.

Working in collaboration with the Heifer headquarters staff as point of contact, and staff representatives in each country, the relevant local entities will source relevant information and application. Strategies for doing so should be included in RFI responses by potential bidders.

BACKGROUND:

An estimated 570 million small-scale farmers produce 75% of the world's food supply, providing a livelihood for approximately 2 billion people. Women comprise 30-60% of these farmers depending on geographical region, and 40-70 percent of the labor (Food and Agricultural Organization of the UN, 2018). Small-scale farms, the core of which range between 2 and 5 acres, are 8 times more effective than large-scale farms in job creation. The World Bank has identified this sector as critical to addressing world hunger and feeding a growing population.

Approximately 70 percent of these farmers cannot verify their rights of ownership or long-term use rights to the land that they farm. Some are squatters on national or public lands and others farm parcels accessed through private markets, customary allocations or other legitimate means often without any legally valid and formally recorded record of their rights.[1] Even when these rights are uncontested , as they typically are, informality leaves these farmers in essentially the same condition as a tenant farmer who: (a) doesn't make productivity enhancing and longer-term investments because the resulting increased property value can't be captured; (b) can't obtain credit and working capital against a fixed asset with better terms that other types of finance; (c) can't accumulate wealth in the form of property that can be passed on to progeny; and, (d) doesn't experience the psychological benefits of pride of ownership, a universally identified value across cultures.

[1] Most modern states (75%) provide for customary land rights as a lawful class of property with equivalent legal protection as individual and state granted private property (Liz Alden Wiley, Customary land tenure in the modern world, rights and resources, January 2012).

Small-scale farmers also face a $450 billion shortfall in working capital and credit to purchase inputs such as seeds, and fertilizer to increase yield. Capital short falls for inputs can reduce yield by up to 40 percent. In addition, women are more at risk financially than men because they have a more difficult time securing loans for inputs, resulting in further negative stereotypes and self-fulfilling prophesy.

Even though governments and donors have increasingly recognized the value of securing and documenting land rights to spur agricultural development and inclusive economic growth, the need is still substantial. While progress has been made, solutions have not been sufficiently incentive-compatible for rights holders, governments and other stakeholders to achieve sustainable results at scale.

Many governments have or are in the process of implementing land governance or land administration reform programs, often funded by international development assistance agencies or multilateral and regional lending institutions. These programs include land rights documentation, digitizing and automating land registry and mapping services.

The reforms aim to build the capacity for good governance of land rights considering the following:

1. The lifeblood of a country's land tenure system is social agreement and clear rules about who has what rights for what purpose. This typically requires changes to policies, laws and norms defined by broad stakeholder engagement.
2. Documentation and registration of rights are critical, among other necessary ingredients, to leveraging a country's land tenure system for economic development at the individual, household and enterprise, community and national levels. Secure tenure is not always dependent formal records of land rights. However, when rights are documented and accessible through efficient, affordable land registration systems, incentives are stronger, and risks are more easily identified and managed. Essentially, a registry, when well developed, provides reliable information (identifiable property rights and accurate records of changes) that improves/allows for extra-local exchange such as land markets/access and credit markets.
3. Documentation and registration of land rights needs to be accompanied by an improved land administration system (to archive records, manage changes to records and provide land information services) and enhanced land governance (improved policy and law that increase transparency, accessibility and equity and effective courts for redress of individual and collective grievances). These broader reforms will ensure
4. With the foundation of good land governance in place, there will be strong ability to develop land, leverage it to secure working capital and potential to add subsequent parcels and transfer it to increase generational wealth. Research has established a direct link between land tenure security and land use efficiency (references below).
5. Closing the gender equity gap by ensuring new or existing land records include women individual or under joint ownership/tenures. Frequently, when land is

titled, re-titled or transferred, ownership goes exclusively to men at the expense of women. Helping women obtain land title and tenure security is of high importance.

While our initiative is cognizant of the remaining needs on the above agenda including in the two pilot countries, Honduras and Malawi, it will support efforts with partners in country, at the local and/or national levels, to address the land documentation and registration constraints that affect the ability of farmers participating in Heifer's efforts to improve livelihoods through improved engagement in supply chains e.g., for Cacao in Honduras. The initiative is considering ways to work with governmental land administration efforts and provide complementary services.

ORIENTATION & GOALS:
Land is the primary asset of the poor, small-scale farmers. Land registration is an important ingredient for the development of family and individual assets that can be leveraged to increase economic wellbeing. Our land registry initiative aims to assure that farmers participating in Heifer's supply chain obtain and register formal records (titles to private lands, customary certificates, long-term leaseholds, or other as might be relevant) in a manner that will improve their access to inputs like credit, enhance their incentives to invest and build wealth over time. At the same time, the initiative seeks to demonstrate innovative technology solutions that could help scale and sustain registry services - supplying more accurate, secure, and accessible land rights information – and illustrate the power of linking land registration intimately with behavioral incentives, financial services and risk management solutions. The linkages will increase demand for land rights documentation and transaction registration to keep records up-to-date and will enable benefits to emerge sooner and more amply.

DESCRIPTION OF THE LAND REGISTRY SOLUTION SOUGHT

The offeror will collaborate with Heifer in Honduras and Malawi to design, develop and deploy a blockchain technology, and be able to be tailored to suit diverse local needs and contexts at reasonable cost and time; the offeror will configure for Honduras and Malawi projects.

The solution must also be designed to relate to and interface with the additional components including (a) risk assessment tool, (b) financial and behavioral change component and (C) supply chain technology. Information
and time will need to be provided to address interface issues, work with additional vendors, if applicable, and ensure potential of seamless integration later. A fully developed application is not required for beta tests in Malawi and Honduras.

BENEFITS OF BLOCKCHAIN REGISTRY:
This RFI calls for the use of blockchain technologies.[2]The potential benefits of a blockchain registry solution include, but are not limited to: reliable and immutable

[2] Our views are informed by recent analysis e.g., Michael Graglia and Christopher Mellon 2018 "Blockchain and Property in 2018: At the End of the Beginning"and our discussions with industry actors.

records in a system in which it is simple, fast and cheap to administer, update and process data, which can be done almost instantaneously, can decentralize access and enhance transparency. These features make doing due diligence on property ownership and other property rights easier.

However, like any automated, digital information system, the underlying information must be of sufficient coverage and accuracy too. Governmental projects to document and update land records are necessary but can take a long time to complete at the national level.

Block chain solutions offer the potential to improve the management of records and information about rights in places where the public registry is sufficiently up-to-date, comprehensive and reliable – it adds value but is not a substitute for formalizing informal rights, for addressing corruption and for resolving disputes.

The project could, for example, support a government authority to deploy a blockchain registry solution in conjunction with efforts to update existing records and document informal rights e.g., in Malawi this could be done as another pilot within the existing government efforts to pilot implementation of the land law.

Block chain technology also offers the potential for groups, e.g., a producer association to create their own ledger of land rights claims validated through a virtual notary function among local members or others in the area. Transparency and access improvements using block chain translates into individual trust in records and feelings of security. Claims can be tagged if there is a dispute and the chain updated when a dispute is resolved.

In Honduras, the project plans to work with the government to achieve land titles for a producer cooperative's members and help them register these as appropriate with the public land registry. That will take time. In the meantime, the project will support a blockchain registry solution for the cooperative to provide credible digital information about the tenure of the farms of its members, which the participating financial institutions can use in loan decision-making.

With the platform of interlinked technology solutions that the project is planning to develop, the registry information will interface with banking functions, working capital records, obligations, mineral rights and all data will ultimately be virtually available instantaneously. Even though administrative streamlining outside of technology might be needed, these technology solutions proffer significant savings in business processes efficiency, time and administration fees.[3] It also offers the potential for seamless integration of government and private records, without costly search functions and wasted time.

BUSINESS CASE:

[3] Note that technology can add value in this way by automating steps or obviating the need for steps in a process; however, like the data point made above, it won't completely substitute for often needed business process streamlining on the part of the public land administration services.

To demonstrate the value-added benefit of both using blockchain enabled registry solutions and of the interface with other elements of the technology platform (risk assessment and finance and behavioral change) offeror will develop a model for and collect data on metrics of success and return on investment. This will be done in collaboration with Heifer's project team, advisory board, relevant government, donor and civic partners for each country pilot. This should include the costs and benefits of different components of the project investments and document the value addition from the digital, blockchain enabled registry solution. For example, information on cost centers; delivery and upkeep costs should be indicated, even in the form of parameters for this RFI.

Cost considerations in delivering registry applications to the field are extremely important; they vary significantly by project and country.

The costs of inaction are significant when compared to a well-managed program, with clear financial objectives. As an example, though with a very different context and a related but different purpose than this initiative, a targeted return on monies spent was achieved in two years and evidence from the European project, an initiative of the European Union, demonstrates significant savings calculated on digitization costs over ten years against what it cost to continually upkeep paper documents (Benefits, costs and risks of business process digitization programs, NSW, state archives and records, 2015; Collections trust, the cost of digitizing Europe's cultural heritage, shaping Europe's digital future, 2007)

A visual matrix highlighting the critical/key benefits and cost streams for the business case will be required in the RFP stage as part of the proposal. The respondents to this RFI are encouraged to provide a descriptive draft in their response.

THE LAND REGISTRY SOLUTION:
In this section, we provide a preliminary specification for the land registry solution and its applications in the Heifer Honduras and Malawi country pilot projects. The offeror is expected to use this as input to the design of the solution and provide a final specification. The government of Malawi has requested that the system be 'open source' and care must be given to ensure security is addressed as indicated below.

The Heifer contract manager will approve the final specification including the review by its Advisory Board for this initiative, prior to developing a beta version of the solution.

MVP Approach:
To address concerns about sustainability, affordability, function and scalability, the land registry solution should be designed using a Minimum Viable Product approach that seeks to provide the minimum functionality needed to suit the needs of the envisaged users for each pilot application that can be upgraded over time to adjust to expanding demand for services and new functional needs and adjusted to new contexts easily and at low cost.

Function:
The land registry solution developed for this initiative will apply to the relevant forms of tenure for the participants in the Heifer supply chain projects as described above including private individual parcels, individual parcels within customary or community lands, and long-term leases (10 + years). The solution needs to treat long-term leases the same as private land. In Malawi, for example, land leases are often granted for 99 years, yet in Honduras they may be granted for five years or less. This category differentiation should be considered for the purpose of financing longer-term debt. Shorter-term leases should be recorded as leased land.

The registry solution, according to the pilot context, will contain documents for use by (a) property owners and lessors, and (b) governments. Transfer of title or ease of transmission of title will be facilitated to third party users (e.g., financial institutions) on a going forward basis. Information needs to be provided that ensures permissioned access, guidance, rules, roles and authority for each function.

Primary functions include:

1. Registration of rights and records
2. Business & Financial transactions (accounts, moving/accepting funds)
3. Asset and title transfers (or other legal documents recording land rights such as a customary certificate of ownership)
4. Regulatory obligations
5. Updating records

Clarification of terminology:
For purposes of clarification and shared language, please note that a Certificate of Title recognizes the right of a person or people to own and hold a piece of property, it spells out ownership. Titles are not deeds; deeds are legal instruments used to transfer a title from one person or entity to another, including tenancy in common. These are frequently confused, causing design and configuration problems. The offeror chosen to undertake the design of the land registry solution is expected to a) ensure the solution is configurable/customizable for any context in which it will be used in regard to specific terms and forms of rights and document used to assign, transfer, encumber or modify rights; and b) to ensure clarity of terminology for the applications designed for Heifer's Honduras and Malawi pilot projects.

Recorded Content:
Following is an illustrative specification of the types of information necessary and specific data that the registry solution will need to hold and/or display for each property included. Each country's property documents may appear different visually or emphasize specific data and each country may have various forms of documents according to different tenure types. In general, the following information for land records (such as land titles) appears in Malawi and Honduras where our pilot projects are being planned. The following data fields also reflect review of land title registries in 6 additional countries including U.S., UK, Australia, New South Wales, Germany and South Africa.

The system design must, to repeat, be flexible enough to digitize data and manage content in accordance with the local context (tenure forms, national laws and standards, presentation of content, for example legal seal, and user needs).

Basic Property Information:

1. Name of current owner (s)
2. Property address or location
3. Land description including lot and plan number, identifiable boundaries (applicable information depending on context and availability); other register interests on the title, mortgages, borrowings, easements and covenants; and strata or communal recordings
4. Type of tenure
5. Type of documentation of tenure rights (class of title, or another formal document, informal document with specifications)
6. Date of first registration
7. Easements
8. Leasehold agreements
9. Date of registration of current owner
10. Purchase price where relevant
11. Restrictions on power of sale
12. Positive covenants
13. Notices
14. History of ownership or legitimate claim of rights, sometimes referred to as 'chain of title'

Parcel survey map:

15. Parcel boundary description (the ability to upload, transfer and record geospatial data should be included in the functions of the registry as well as the ability to digitize paper parcel sketches or photographic evidence).
16. Features of the parcel
17. Map scale
18. Certificate/title number from the public registry and/or cadaster

Property boundary quality:

19. Agreements
20. Disputes
21. Registry and legal boundaries
22. Date of recording
23. Mineral rights (especially important for individual rights)

The Screen and Display of information:

Cognitive design principles will be applied to screens, accessing and visualizing records. The purposes are to increase (a) ease of user engagement, (b) proficiency of reading data, and (c) ease of navigating information. Special attention will need to be given to clarity and demarcation of information including introductory headings, segmentation, and sequencing of information. While it's critical to parallel existing national documents and records in substance and layout, improvements can be made in overall introduction, how

to use service, and framework of presentation. Sample elements of critical data and information are provided above.

Signature System:
A method for signing documents and recording signatures must be designed for and viable within the context of the country of application. Security is critical and interface with biometrics is important, as Malawi has this system in place already.

Navigation:
Best practices in furthering ease of navigation will be implemented. This includes state-of-the art navigation for mobile, desktop, and tablet, in that order. Ease of use and responsiveness to thumb and fingers needs to be designed in. Uninitiated users will, most likely, use their fingers to engage with system. Consumer models of selecting and ordering merchandise off mobile phones serve as a good example of highly developed ease of navigation.

Rating for Service Feedback:
A service feedback rating scale should be included to allow users of the document service to provide feedback. A simple set up of emoji images utilizing an extensive scale, smile to frown, will be sufficient to allow users to feel valued and alert us to problems. The greater the appeal to an individual's sense of controls the better the user engagement.

Extensibility:
The land registry should be designed with an eye to adding additional services, perhaps as modules. While this is not necessary in application for the MVP, it should not be precluded from the design. Offering one location for storage of various critical household documents (birth and marriage records, for example) could be highly valuable to governments and individuals in the future.

Security and Privacy:
Security of data and privacy of information are major issues. The solution must provide a dependable archive of records based in an infallible technology. The following should be considered: a) how the data are protected in case of national disaster, for example earthquakes, or other threats; and, b) rock solid privacy and security, in case of hacking and break-in. Defenses against fraud and corruption whether from petty acts by public officials, land-grabbers, identity-thefts or other hackers are imperative. Change of governments due to coups or contested elections can often lead to altered or confiscated property records.

Privacy: Individual identity, ownership, financial matters, and transactions must be protected from outside access, except by those permitted to do so. A digital and blockchain identity system must be put into place to protect individuals. A privacy system may need to include fingerprint access, and/or biometrics, and use of private blockchain keys. The fact that blockchain enthusiasts often tout that the configuration of nodes offers 'no single point of failure' is, in matters of security, misleading (Cyber-security below).

A separate but intrinsic part of the RFI package will call for the development of adequate identity solution for the components of the technology platform and each component needs to include appropriate measures to protect privacy of data and identity including rights holders and transacting agents whose information is in the system.

Cyber Security:
Security is so important that the comments and guidelines below apply not only to all work to be undertaken by the operator selected under the RFP that will follow this RFI for the land registry solution, but also to the financial platform and to risk assessment. Security is a zero-tolerance practice and generalizable. Mistakes in the area of security are costly for reputation, loss of documents and trust of users. They are difficult to recover from, and must be eliminated.

Land titles and records are the backbone of an economic system. They must be protected from cyber-criminals and attacks. Following are highlights of a defense in depth strategy, which should include exploration of firewalls, virtual private network, intrusion detection and prevention systems and managing node down time, all considered from day one and on the application level. A cost benefit analysis of tradeoffs between ultimate security and affordability will be conducted.

Following are guidelines for cyber-security:

1. Standards: Follow National Institute of Standards and Technology (NISI) guidelines for sensitive information: no data access or disclosure to unauthorized individuals, entities or processes.
2. Standards: Follow RFC 4107 Guidelines for cryptographic key management—IETF tools and documents available.
3. Begin land registry design with prospective cyber security controls, due diligence, and practice procedures, in order to develop a complete risk profile. Planning for cyber-security is not an add-on technology or strategy.
4. Design for full end-to-end encryption, full block data encryption and AAA capabilities.
5. Design for Distributed Denial of Service (DDOS) attacks as these are on the rise. Consider that on October 2016, hackers disrupted the services of Twitter, Netflix, and Spotify, all high traffic and dense with technology.
6. Design or consider special purpose key vaults and cryptographic algorithms; consider using encryption keys in conjunction with any public key infrastructure (PKI).
7. Recommend governance framework including roles, accountability, access and performance metrics, especially for insiders with access to files, and data.

Integrity:

1. Establish guards against improper information modification or destruction ensuring information non-repudiation and authenticity according to NISI standards.

2. Design for data encryption, hash comparison (data digesting), use of digital signing, and protection of data storage and in-transit information; be able to store data outside of the immediate system.
3. Smart Contracts: Plan for security all along smart contract life cycle: creation, deployment, and management.
4. Practice secure software development life cycle to protect against threats of bugs that can be exploited.

Availability:

5. It is important to ensure timely and reliable access to and use of information in a cyber-protected environment.

Evaluation:

Potential technology and development partners will be evaluated on the quality of information provided on the following elements:

1. Problem solutions that are elegant, robust and meet the challenges of context (potential electricity failure, 3-G and undependable networks, including power surges)
2. Demonstrated proficiency and best practices in design of relevant technology solutions with the operational and security features illustrated within a MVP approach.
3. Prior experience with/understanding of land registry software systems and land administration services.
4. Ability to balance innovation and budget constraints to deliver a leading, quality product that's affordable and operationally sound
5. Ability to dedicate appropriate, highly skilled staff to develop and deliver project in a timely manner
6. Successful experience in developing complex record systems

RFI #2 -20210518, Developing A Risk Management & Assessment Tool for Small-Scale Farmers to Increase Resilience and Yield, and Lower Costs of Capital and Crop Insurance

Beta locations:
Malawi, Africa; Honduras, Latin America

BACKGROUND:
An estimated 570 million small-scale farmers produce 75% of the world's food supply, providing a livelihood for approximately 2 billion people. Women comprise 30-60% of these farmers depending on geographical region, and 40-70 percent of the labor (Food and Agricultural Organization of the UN, 2018). Small-scale farms, which range between 2 and 10 acres, are 8 times more effective than large-scale farms in job creation. The World Bank has identified this sector as critical to addressing world hunger and feeding a growing population.

The small-scale farming sector is extremely fragile. This is due to several exogenous factors that can negatively impact efficiency and yield. Global warming is driving fluctuations in weather patterns—drought to high precipitation--- increased air and ground temperatures, and accelerated attacks by pests and pathogens on plant biomass. A 'fat-tailed' uncertainty in the economics of catastrophic climate change is looming. This means that we may not be able to predict the downside limit of negative impacts. These attributes are driving an underlying perception of risk, rational and irrational. New approaches to building resilience and risk management need to be developed and deployed. Field assessment and anomaly event modeling are required to successfully adapt to new environmental challenges (references below).

Risk Management & Parameters:
Risk, from a credit point of view, is defined as the probability that an individual or group will repay a loan. Put simply, potential failure of loan repayment is a measurement of risk. In our model, there are three primary factors that impinge on the likelihood of loan repayment, each with its own set of probabilities, management strategies and outcomes (references below). They are:
1.Individual behavior: Some individuals, for whatever reason, fail to repay loans. They will form a statistical part of whatever actions and programs are undertaken. Risk avoidance strategies can be put into place, however, to control losses. Biometrics was introduced in Malawi, for example, making loans easier to track and hold individuals accountable. Behavioral strategies are also possible. For example, offer opening credit rates beginning at 15% and when prescribed repayment schedules are met, short term and serially, rates automatically drop to 10%. In the US context, statistical approaches were employed by Capital One to build a multibillion-dollar business by learning how to provide credit to financially marginal individuals.
2. **Field economics**: The ability to generate income through farm practices over and above subsistence is critical to loan repayment. This factor, from our perspective, is every bit as important as individual or group behavior in determining repayment. If there are insufficient monies to pay overhead, invoices for inputs, and/or health care, it may be

impossible to service loan obligations in a timely manner. Management and risk strategies are designed to increase resilience to improve yield and lower costs, making credit payments more likely. Blaming the victim for structural and economic problems is ill advised, leading nowhere.
3. Exogenous events: These include the impact of (a) weather (parametric measures) and (b) commodity prices. The dilemma that farmers often face is that yield increases, but commodity prices decline. Data and strategies can be developed using extreme value theory and price displacement models to adapt. Extreme value theory addresses tails of distributions beyond the range of existing data; or put statistically, beyond Gaussian distribution---the normal distribution curve.

Framework:
Our framework aims to build farm resilience and yield through managed risk; and apply this to an ecosystem of small-scale farms. A farm system is resilient if it can adjust its functioning prior to, during, or following events (changes, disturbances, and opportunities) and thereby sustain required operations under both expected and unexpected conditions. Resiliency, in a farm setting, also has a socio-ecological dimension, requiring individual and group learning and adaptation (references below).

The management and risk assessment tool will be designed to build resilience and yield while anticipating the changing shape of risk before failures and harm occur, even in situations where events may stress the coping mechanisms of people and plants. Increasingly, the quantity of perturbation (s) translates into a quality of degradation, whether that degradation effects quality of soil, water uptake, timing, evapotranspiration, pest proliferation, pathogens or other plant dependent factors (references below). Statistically, disruptive events which were once low in frequency are becoming more frequent; this can be costly to farmers.

Our approach to building resilience and managing risk is preventative. It is based on a number of disciplines including biology, ecology, agriculture, engineering and credit studies. We intend to build a quantitative and qualitative model to enhance systems resilience, to increase yield, reduce risk and costs of capital across several domains (see below). Our aim is to generate robust data and strategies that are actionable and simple enough for farmers to use effectively in the field.

The model, behind the scenes, consists of AI and machine learning algorithms that apply operations from an advanced credit model, extreme value theory, multi-variate regression analysis and hedging strategies for parametric and price volatility. The credit model used as a point of departure is being deployed in international markets today, outperforming FICO on predictive analytics. It is being further developed and adapted separately to interface with results from our individual and field assessment tool.

Operationally honed behavioral schemes based on trait, pattern and impact analysis will save farmers time and effort. Our computational field model will aim to answer the question: which key constellation of variables is worth attending too to reduce risk and enhance yield, and by what amount. It offers a dynamic model of farm resilience and risk

management, employing the application of extreme value theory and related strategies. Extreme value theory offers a proven way to cluster variables beyond normal or gaussian distribution models (references below).

While our field model will evidence a high degree of accuracy, helping farmers to build resilience and lower costs, we anticipate using natural language for field descriptions such as “best case scenario”, “trends and tendencies” and highest “probability of positive outcome”.

Business Case:
Our resiliency and risk mitigation models and tool are anticipated to increase yield and reduce costs of: (a) working capital, (b) crop insurance, and (c) down time and recovery of fields subject to negative impacts. These reductions are anticipated to add significantly to the economic wellbeing of farmers. Cost reductions for preventative and prescribed behavior are common practice in lowering insurance premiums, for example installing smoke alarms in your house or demonstrating good driving behavior; and they form the rational basis for pricing the cost of capital. Economic formulas and strategies will be developed to drive an empirically solid business case.

Potential cost savings by segment are highlighted below.
Reduced Risk and Cost of Capital:
Lack of capital or its availability at high interest rates for short duration (18-40% interest, 9-12 months, for example) is primarily due to (a) anticipated risk before actual events, and (b) the perception of lenders— ‘cognitive framing’--- that loaning money to small-scale farmers is high risk. Credit studies from the field, however, indicate that overall default rates in farm loans over time are no greater than comparative commercial loans, which are funded by banks.
Women, furthermore, are subject to a cognitive bias, viewed as higher risk, in spite of data to the contrary. They have a more difficult time securing loans than men and are often subject to higher interest rate loans secured in informal markets. Women also have greater difficulty in securing land ownership and titling documentation processes. We address these gender equity gaps through our ownership, documentation and titling, technology and funding programs.

Since agriculture is a capital-intensive industry, even on a small-scale, the increased cost of borrowing has a negative impact on the value of the farm and land itself. Higher loan costs, in other words, result in lower economic value because the primary asset, land, generates less free cash flow.

Addressing risks to secure working capital on more favorable terms is important for livelihood and wellbeing. It is also an indicator of financial inclusion: enhanced borrowing capacity to purchase inputs, and generate increased operating profits helps small-scale farmers, particularly women, join the economy at large and become stakeholders in the full sense of the term. Special attention will be paid to closing the gender equity gap.

Crop Insurance Premium Reduction:
Crop insurance premiums are expensive for farmers, and the smaller the scale of operations, the more expensive the price to yield. Premiums are based on (a) historical yield, (b) price and volatility of crops and anticipated earnings from income streams. Farmers, in some instances, can purchase coverage against yield and/or revenue protection. In the US context, CME group futures and market prices can help determine revenue coverage. At some points in history, for example, the market price of maize can be 50% determined by financial traders. Local commodity exchanges will need to be modeled at a later date.

Our risk management tool is anticipated to reduce crop insurance prices by anticipating and addressing risk directly in the field. A simple price to value model for farmers will be developed at a later date.

Recovery Time and Capital Efficiencies:
Farm recovery post damage is critical. Farmers, for the most part, stay put on their land and learn to face the consequences of negative events. Since their land is their asset, the faster that it can return to production post damage, the better off for individuals and families. We intend to implement strategies to address resilience, perturbations, and extreme value events, ultimately developing economic formulas to model recovery time and returns.

This should also have a positive impact on farmers sense of control and psychological wellbeing. The greater the farmer's perceived control over events, the greater the feeling of personal power, and the less the potential for depression and withdrawal from work in response to working hard and seeing few results or experiencing losses (references below).

Goals:
The ultimate goal of this project is to develop and use digital tools and blockchain solutions to help farmers build farm resilience, increase income, and partake in the full value of their land. We aim to accomplish this through developing strategic resilience, reducing risk and cost of capital, crop insurance premiums, and accelerating time to recovery. Pursuit of these goals includes application of infrastructure improvements, technology, algorithms, and systems to (a) define and operationalize resilience and preventative systems, (b) gather field-centric underwriting data to reduce risk and anticipate outcomes (c) provide a method whereby crop insurance companies can review farm practices and risk model to lower premiums, and (d) complement additional activities like access to market, and supply chain management to increase farmers potential for success
The results are anticipated to be sustainable due to the project's utilization of incentives for behavior change, gender equity, and capacity development as addressed in the content of parallel project documents.

PURPOSE:
The aim of this **request for proposal** includes:

1. To provide the necessary elements for design and build of an MVP (minimum viable product) Risk Assessment App to be used by small-scale farmers to gather data on risk. The desired outcome is the development of an App that is mobile-centric: easily downloaded, used, and distributed over mobile phone.
2. To provide key data points that inform a Risk Assessment App (an intake form), which can be utilized by farmers and accepted by financial institutions. Data points are provided herein under the section entitled Risk Assessment Form: Sample Data Queries. This Form will be used to gather data in order to build a baseline and supply referenced data to an AI and machine-learning program that will process variables and establish a Risk Profile.
3. To provide a cognitive framework to grasp what risk means in a farming context, how it differs from consumer risk and how to translate risk assessment into a digital tool that can be used by farmers and relevant personnel.
4. A simple system for cognitively reinforcing behavior should be developed; appropriate memes will suffice (like clapping or thumbs up after completing a section of input).
5. To indicate high-level mobile-centric design principles of UX/UI to establish framework to engage users.
6. To provide groundwork to interface with blockchain and systems designed to meet overall objectives of the project.

SCOPE:

1. The scope of this document covers key variables that inform the content and design of a Risk Management and Assessment Tool in the form of a digital APP. This tool for data inquiry, will: (a) improve the identification of risks in a field setting, gathering baseline data to create the basis for a risk profile; (b) serve as a skill building tool to empower farmers to address and manage key risks, (c) provide an alternative to FICO score consumer models that are often mistakenly applied to farmers and risk and (d) lower costs of capital due to reduction of uncertainty leading to higher probabilities to meet loan obligations and (e) lower costs of services such as crop insurance.
2. The key variables incorporated into the Risk Management and Assessment Tool are based on reported case histories and field research in both agricultural and credit and repayment reports (successful repayments and defaults) derived from Africa, and Latin America, the contexts in which the MVP will be tested.
3. Demographic and psychosocial information from credit studies also informs the choice of data fields.
4. The wild card in planning for risk abatement and repayment of loans is climate change. Climate change is an independent variable not covered directly by the Risk Management and Assessment Tool. Climate change impacts will be modeled in the technology and risk profile being developed to analyze data that is gathered in the field. That model includes probabilities and estimates of extreme value events, scenario modeling for worse cases as variance from baseline data, and normal distribution.

5. Risk in this model is treated like a negative externality, like smog, soot from coal plants, or damage to soil from clear-cutting forests. It is internal to the process of farming and must be managed.
6. The Risk Assessment and Management Tool will include the application of cognitive science to the organization, layout, and application of data sets closer to the actual time of building the model to be tested (See point #3 under Objectives, guidelines below).
7. Visualization of data and ease of transfer to operational strategies is critically important.

OBJECTIVES:
Farming is as much risk management as it is growth management; risk management is especially important given climate change, the limited resources of small-scale farmers and the high cost of capital.

The primary objective is to design and build farm resilience through a Risk Assessment and Management App with APIs (functions and procedures) necessary to engage users to complete a Risk Assessment Form and click to send answers to our identified processing source. The App will be a fast load and operate easily on a mobile phone. Communication of data will, most likely, occur over a basic 3-G network.

The Risk Assessment and management App will be designed to function primarily as a data assessment tool and secondarily as a training tool. Users will grasp, through cognitive framing of each section and required answers to queries, the importance of assessing and managing risk in the field. Risk assessment will be reinforced through framing sections of questions and users providing answers; it is geared to preventative action.

Outcomes of APP use include:
1. Improved data gathering
2. Increased control over field outcomes
3. Increased productivity
4. New skill development for farmers
5. Multiplier effects, generalized learning to additional activities
6. Positive impact on increasing gender equality.
7. Increased preparation for extreme events

The APP and its contents will serve as the basis for farm certification in resilience and risk management. The marginal utility value of certification is determined by opening access to working capital, and infrastructure items that increase land value (irrigation, for example), lower operating costs and increased control over negative impacts, reducing down time and loss of income.

Following are **guidelines** to meet user project objectives:

1. ***Enhanced user engagement***: UX/UI design executed as if it were being designed to enhance consumer engagement. Farmers are our consumers in the field. The design will be mobile-centric.
2. ***Cognitively simple to engage and use***: parsimonious, intuitive, flat design, with visual emphasis and sequencing will be ideal. Navigation designed to be self-evident.
3. ***Cognitively engaging to answer required questions***: for example, framing a header with a picture of a bountiful farm; below are identified sections to frame questions in a user-centric way (About You section would include questions on gender, age, and off-farm employment, for example) requiring responses; sequenced questions in a font that's easy to read and respond to; finger-friendly tap targets are important; periodic brief summaries and reinforcement for continuing (good job, next); (imagine that you are creating a simple farm game and want to increase user engagement—not a boring list of data points to be checked off)
4. ***Designed for interruptions***: queries for answers should be easy to refresh or re-start without losing prior data input, adapting for battery failures or network malfunction. Interruptions should not lead to information loss; data is automatically saved and retrieval is facilitated.
5. ***Data format and scale for ease of measurement***: tabulation needs to readily translate into mathematical indicators to create baseline and risk profile. Likert scales, (a response rated weak to strong, for example, 1 weak, 7 strong) need to be indicated.
6. ***Designed to easily incorporate updated information retrieved from the field***: this tool will evolve as we get new information from the field and analysis; designed to be easily programmed for updates.
7. **Designed for ease of transmission over 3G networks or applicable to context:** Infrastructure will vary based on country and region. Most likely, over the next 12 months, Space X will have a sufficient number of satellites in orbit to reduce worries, as alternate networks will become available.
8. **Designed for resilience:** data needs to be secure, protected from hacking and theft. Banking industry standards for security in US or Europe Union to be used as guidelines.
9. **Designed for visualization of data**: geo-location of participating farms and loan portfolio and all key data measurements.

The vendor should plan on **submission of two wireframe mock-ups** of screens for feedback prior to sign-off for finished MVP product.

WHAT THIS IS NOT:

In terms of design and layout this is not Survey Monkey:

1. This is not a list of data points to check off
2. This is not a one-time response, tabulate and go
3. This is not a tool to surreptitiously gather data

USER PROFILE:

Primary users will, most likely, evidence the following characteristics:

1. Average age range of core users is anticipated 40-50 years, although some users will tend to be younger, 25-30 years. This is difficult to know exactly because we don't yet know who will record the requested data.
2. Primarily male; however, design will promote gender equity
3. Education level US equivalent, 4th grade; basic literacy obtained
4. Basic skills with mobile phone
5. Languages: English (Malawi), Spanish (Honduras)

DEFINING RISK APPROPRIATE TO FARM APPLICATION:

The following points present context and limits of existing underwriting methods—risk assessment--- applied to consumers as well as small-scale farmers in developing countries. FICO was selected as a point of reference for several reasons (a) it is the standard risk assessment profile used by 100 of the top banks and credit card companies in all regions in which we operate—90 plus countries, (b) all key banks in Honduras depend on FICO to optimize lending decisions and the company has provided South Africa with credit scoring criteria for approximately 20 years and is expanding in the region.

1. Risk profiles are highly developed in the consumer industry of advanced industrial economies, with over fifty years of refinement. FICO scores and algorithms are the most utilized method to assess consumer risk. FICO scores were developed by Fair Isaac to assess an individual's creditworthiness. Scores range from 300 to 850. Consumer loan costs and access to credit are more favorable with higher scores.
2. Financial Technologies are, for the most part, positioned as innovations in Fintech. Applications via mobile phone are being used in the agricultural field to lend money to small-scale farmers. They are based on FICO-like models and scores. In other words, creditworthiness of farmers is determined by such behaviors as paying grocery and mobile phone bills in a timely manner. This application to farming is highly limited and, in many cases, misleading.
3. While past behavior often indicates future behavior---if you paid your bills previously in a timely manner, you are more likely to continue that behavior--- it doesn't apply, however, to the vagaries of farming and the actual variables that determine outcome, ability to pay, and a real profile of risk.
4. No prior planning for everyday risks involved in farming is accounted for, nor high interest rates that are burdensome, nor poor timing of funding and its impact on repayment of loans, all of which have a far greater impact on ability to repay loans than an individuals' track record paying a mobile phone or grocery bill.

Risk Management Tool:

5. The Risk Assessment and Management Form (the tool) is anticipated to provide accurate data applicable to small-scale farmers and farming to reduce risk (uncertainty) and therefore, cost of capital and crop insurance.
6. Three key areas of risk are accounted for in our risk assessment form: (1) capacity assessment: to meet general obligations, for example land ownership, and determine developed state of the property's infrastructure, (2) agricultural risk

itself: impacts that directly influence plant growth and yield, and exogenous factors, climate change and weather and (3) individual factors that impact achievement motivation (known as N-Ach), such as land ownership and property rights, anticipated control over outcomes and motivation to succeed.

7. The Form to be used as an intake tool, evidences each one of these classifications or areas of data, (an organized grouping of data) directly or indirectly. For example, gender is included as a query; although seemingly prosaic, women tend to have higher rates of repayment than men. This affects risk profile.

8.The content of the intake form will be improved, as it gets closer to actual development. The data herein is more than sufficient to accurately bid the project and provide time frame.

9.The intake form and its assessment capabilities will also be presented to crop insurance companies to address risk and lower insurance premiums.

10.Currency conversion capabilities need to be installed.

ASSESSMENT ITEMS & DATA FIELDS:

1. A relatively new discipline of credit studies applied to small-scale farmers allowed us to select and feature key items for query in addition to traditional agricultural research. Information from credit studies is incorporated into the Risk Assessment Form. As we gain new knowledge from users, field practice, baseline data and mathematical analysis, we will need to update our form to include new data elements.

10.The data queries in the Risk Assessment Form, in other words, are designed to demonstrate internal consistency with farm risk. It will, over time, (anticipated to be crop-dependent cycles of 12 months to 36 months) form the basis for a more sensitive assessment of risk and optimal behaviors to improve practices to meet loan obligations.

11. The Risk Assessment and Management Form data chunking and queries featured in the last section will be refined and ordered for the MVP at the appropriate time.

INTEROPERABILITY PARAMETERS:

Interface factors with system elements internally and externally includes (1) blockchain elements and operations for overall program, (2) resiliency on security and privacy designed to US or European Union standards, and (3) congruent with banking and mobile standards. Security is a top concern (see Land Registry RFP).

Back-up plan:

A back up plan must be developed to address and compensate for (a) periodic power outages and surges that may disrupt recording, storage and transmission of data.

EVALUATION FACTORS:

The challenge of this proposal is to design and build an App with APIs to engage users and operate The Risk Assessment Form. It will be evaluated for:

1. Creative, best practices mobile design to maximize engagement of users and meet objectives

2. Designed to motivate users to tap answers to data queries, making ease of response a priority; in other words, key stroke level modeling should be conducted
3. Mobile responsiveness with system geared to adapt quickly to power or other interruptions to avoid losing data and starting over; ease of information retrieval is critical
4. Technical expertise demonstrated in design to utilize less power supply and easily transmit information in a 3-G or low transmission environment
5. Demonstrate contribution to improving App user experience, engagement, and assessment
6. Usability (study) in the field
7. Resilience in security and privacy issues
8. Ability to complete work on time and on budget

RISK ASSESSMENT & MANAGEMENT FORM: SAMPLE DATA QUERIES:

I. BACKGROUND DATA

1. Gender

___Male ___Female

2. Farmland size (hectares)

___<1 ___1 ___2 ___3 ___4 ___5 ___6 ___7 ___8 ___9 ___10 ___10+

3. Land ownership (with full and registered title): Yes No (if no see below)
    a. What type of land rights claim do you have?
        a. Lease
        b. Long term occupant with valid untitled land ownership claim
        c. Tenancy in common, community title
    4. If lease, how many years remaining on lease

___<10__10 ___15 ___20 ___25 ___30 ___40+

5. Land lease (renewable) Yes No

6. Land lease payment and tax payment annual:

___<$500 ___$1000 ___$2000 ___$3000 ___$4000+

7. My land title/ lease is secure-------No 1 Somewhat 2 Very secure 3

8. Number of family members working on farm

___1 ___2 ___3 ___4 ___5 ___6 ___7 ___8 ___9+

9. Number of family working at harvest time

___1 ___2 ___3 ___4 ___5 ___6 ___7 ___8 ___9+

10. Number of years farming the specific crop funded

___<1 ___2 ___3 ___4 ___5 ___6 ___7 ___8 ___9+

11. Number of years farming

___<1 ___2 ___3 ___4 ___5 ___6 ___7 ___8 ___9+

12. Farmer participation in program(s)

___None ___Some ___Full

13. I generate additional income off-farm during the year: Yes No

II. FARM NATURAL RESOURCES & PRACTICES

WATER:

13. Water (meters to source):

___Nearby 75m ___250m ___500m ___750m+

14. Water availability
___1 Sometimes___2 Seasonal ___3 Year Round
15. Type of water source
___Well ___River ___Lake ___Catchment
16. Installed irrigation Yes No
17. Drip irrigation Yes No
18. Pipe/flood irrigation Yes No
19. Dry farmed crops (rain only) Yes No
20. Water volume sufficient to grow crop
___1 No ___2 Sometimes ___3 Sufficient
SOIL CONDITION:
21. Treated or enhanced soil with fertilizer
___1 No ___2 Some___3 Treated
22. Cover crops
___1 No ___2 Some___3 Cover crops
23. Type soil (sandy; loam; clay; peaty)
___1 Soil NOT matched to crop___2 Some match ___3 Match
PLANT TO ENVIRONMENT MATCH:
24. Sun exposure to crop:
___1 No Match ___2 Some match ___3 Match
25. Shade exposure to crop:
___1 No Match ___2 Some match ___3 Match
26. Temperature to crop:
___1 No Match ___2 Some match ___3 Match
27. Air moisture to crop:
___1 No Match ___2 Some match ___3 Match
28. Solar radiation (sun exposure hrs.)
___1 No Match ___2 Some match ___3 Match
PLANT TO INPUT MATCH
29. Fertilizer to crop:
___1 No Match ___2 Some match ___3 Match
30. Seeds to growing conditions
___1 No Match ___2 Some match ___3 Match
31. Soil additives (Exp. gypsum)
___1 No Match ___2 Some match ___3 Match
PEST CONTROL MATCH
32. Spray
___1 No Match ___2 Some match ___3 Match
33. Natural insect predators
___1 No Match ___2 Some match ___3 Match
34. Seed (GMO)
___1 No Match ___2 Some match ___3 Match
III. POST HARVEST INFORMATION:
STORAGE TO CROP MATCH:
35. Storage readily available
___1 No ___2 Sometimes ___3 Yes

36. Storage usable
___1 No ___2 Some ___3 Yes
MARKET ACCESSS TO CROP MATCH:
37. Vehicle to deliver crop (truck):
___1 No ___2 Sometimes ___3 Match
38. All-weather roads to market: No Yes
49. All-weather road transport (animal transport) No Yes
40. Time to market (hrs.) ___1-5 ___6-10 ___14-18 ___19+
IV. SUSTAINABLE PRACTICES (additional for environmental standards)
SUSTAINABLE FARMING PRACTICES
1. Water conservation program: No 1 2 Some 3 4 Yes 5
2. Shade techniques: No 1 2 Some 3 4 Yes
3. Planting trees program----------No 1 2 Some 3 4 Yes 5
4. Soil restoration program----------No 1 2 Some 3 4 Yes 5
5. Carbon sequestration program —No 1 2 Some 3 4 Yes 5

6. Agro-forestry practices (mixed crops working together) –No 1 2 Some1 2 Yes 1 2

References:

Anderson, Pamela, K. Emerging infectious diseases of plants: pathogen pollution, climate change, and agrotechnology drivers, Trends in ecology and evolution, Vol. 19, 2004
Hollnagel, E., Resilience, engineering association, August 11, 2019
Joyce, M., Bivariate extreme value analysis of commodity prices, UVicSpace, April 21, 2017
Louangrath, P. Stock price analysis under extreme value theory, SSRN, January 14, 2016
Milestad, R., Building farm resilience: prospects and challenges of organic farming, Journal of sustainable agriculture, October, 2008.
Ozaki, V.A., Estimation of agricultural probability of loss: evidence for Soybean in Parana state, Review economic sociology rural, vol.52 Jan./ March, 2014.
Park, E. and Maples, J. Extreme events and serial dependence in commodity prices, Agricultural economics, 2018.
Standish, Rachael J., Resilience in ecology, Journal biological conservation, 177, 2014
Waihenya, A., Effects of credit facilities and agricultural production of small-scale farmers, Kenya, Academia.edu, 2017
Walden, A.T., Non-gaussian reflectivity, entropy and deconvolution, seg library, geophysics, 2016
Weitzman, M. On modeling and interpreting the economics of catastrophic climate change, The review of economics and statistics, 2009
Wiley, Liz, Alden, Customary land tenure in the modern world, Rights and resources, January 2012
Zhou, G. A new non-linear method for calculating growing days, Scientific reports, 8, article # 10149, 2018

APPENDIX:

I. RISK MANAGEMENT MODELS: AFRICA

RISK MANAGEMENT	REPRESENTATIVE ORGANIZATIONS
Pre-qualified Geographical Risk: (a) high-density low-cost reach, (b) high rainfall, and (c) low adoption of fertilizer in fields	One Acre Fund, Juhudi Kilimo (Kenya); & BRAC Bangladesh
Group Liability for Loans	One Acre Fund, Juhudi Kilimo, and BRAC
Mobile Platforms Consumer Profiles	Aella Credit, 2015; Branch, 2015; Farm Drive, 2014; Kia Kia, 2016; M-Pesa, 2016; Microcred Group, 2005; RainFin, 2012
Underwriting Member Bank (s) Agricultural Loan, 75%	Government of Ghana, 2019

II. RISK MANAGEMENT MODELS: LATIN AMERICA

Risk Management	Representative Organizations
Mobil data & behavior	MoviiRed
Credit history	FINCA, DaviPlata
Grain pledging against loan	Fintrac
Identity and transparency data	Banqu.co
Credit & farm data	IncluirTech
Purchase agreements, tech. assistance	Starbucks

ELABORATION ON TABLES I and II:

1. Throughout Latin America, farmers have access to 3% to 14 % of available credit. This is on par with Sub-Saharan Africa, despite higher standards of living.
2. Blockchain: Latin America and Honduras in particular, have a number of young companies utilizing blockchain to (a) establish farmer's identity and transactional data to create credit profile, and also land mapping aimed at women farmers (Banq.co), (b) digital wallet and interface with banks to help small-scale farmers access credit (Grain Chain), and (c) connect global coffee companies with coffee farmers, (Farmer Connect project with IBM).
3. Incutech, Colombia, presents a real difference is assessing risk including creditworthiness of farmer, mobile phone collection of data, demographics, crop production, expected sales price for crop and anticipated cash flow. This is in the

direction of credit data and profile meets Individual Farming Plan. It is a model worthy of additional research.

4. Inter-American Development Bank: Committed $44.7 million loan to Honduras to encourage development of digital economy and increase competition. This effort completely parallels our efforts and should be tapped.
5. The National Agricultural Development Bank has $255 million available for development of agricultural producers.

References:

1. Reinventing rural financial inclusion in Latin America, AgriTech Mobile Money, Dec. 2018
2. Latin American Agribusiness Development Corporation, 2019
3. Foromic conference, financial inclusion, Colombia, 2018

RFI #3 2010519 BLOCKCHAIN-BASED BEHAVIORAL ECONOMIC & REWARDS PLATFORM: OPTIMIZING PARTICIPATION, FINANCIAL INCLUSION & SUSTAINABLE FARMING

Beta Locations:
Malawi, Africa; Honduras, Latin America

PURPOSE & OBJECTIVES:
The primary purpose of this RFI is to develop a blockchain-based behavioral economic and rewards platform for small-scale farmers in the form of an MVP (minimum viable product) to be field-tested in Honduras and Malawi. This relates to, although separate from, the land finance for land purchase or for documentation of property rights and/or improvement to land. It may not apply to the supply chain.

Our behavioral economic and rewards platform is innovative in its application of cognitive behavioral economics and rewards in the form of tokens to shaping behavior of farmers to increase resilience and yields, improve labor input to out ratios, and increase standards of living. It is essentially a delivery mechanism for micro-behavioral change.

Our token-directed behavior is (a) contingent on performance, (b) exchangeable for real benefit, and (c) subject to mutually supportive reinforcing and discriminative behavior; for example, earning tokens for performance and depositing them into an account. Numerical nudging, token rewards that increase with certain activities, will be explored. The data in support of our efforts is derived from agricultural projects in disparate countries over the last decade (business case below).

This MVP will include technology, behavioral economics and rewards to increase:
1. Desired behavioral outcomes and skill transfer
2. Reinforcement of behavior to sustain skill transfer
3. Gender equity and financial inclusion through rewards
4. Sustainable farming practices
5. Interoperability with financial institutions and donors outside of Heifer; with the purpose of being able to agilely and readily accept money transfers and donations

The MVP will also function as a platform to:
(1) Manage money and rewards including savings and loans
(2) Dispense sponsorship dollars (rewards) at low cost
(3) Interface with donors and financial institutions transparently
(4) Provide infrastructure for crowd funding

The MVP should be designed to add modules that accommodate growth and evolution of the business model and required functions.

Rewards form part of a user's financial practices including the ability to exchange tokens for fiat currency or discounts on fertilizer, seeds, tools, and/or mobile services, for

example. The MVP, at its core, will facilitate an applied 'token economy'. It will stimulate development of financial skills and savings as secondary objectives.

Financial inclusion is a byproduct of our activities: 1.7 billion adults remain unbanked. Women are 50% less likely than men to receive deposits directly into their accounts. Our blockchain and reward system will help change this reality dramatically when farmers discover that they can open an account and be rewarded financially for their behaviors in the short term. Explicit efforts will be made to ensure that women are reached and engaged by our systems and that the platform is designed to avoid gender bias.

The MVP should allow for monitoring of user participation including the ability to obtain data to optimize practices and rewards while assuring protection of personal data and identifying information.

Please see section entitled **Scope: MVP Parts & Function** for further details on MVP deliverables.

BACKGROUND & GOALS:
Our token and behavioral economic and rewards platform will aim to meet UN Sustainable Development Agenda Goals 2030, and African Agenda 2063—7 Pillars, a blueprint for transforming Africa. Key goals highlighted below:

1. Double agricultural productivity and incomes of small-scale food producers, in particular women, Indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.
2. Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought flooding and other disasters and that progressively improve land and soil quality.
3. Ensure a prosperous Africa, based on food self-sufficiency, inclusive growth and sustainable development.

Sustainable development as defined by FAO, UN, requires an effective funding and reinforcement mechanism that takes into account a three- dimensional perspective: economic, social, and environmental impact. It is our aim, through advances in cognitive science, technology and reward systems, to evidence leadership in sustainable finance and applied behavioral change.

We aim to close the gap that currently exists between the idealism of sustainable development goals and current practices on the ground.

COGNITIVE SCIENCE
Based on advances in cognitive science, traditional methods of engagement and motivating individuals to perform prescribed behaviors are incomplete, often dated and

expensive to monitor over time. Continual human intervention is often required to ensure that individuals internalize training skills and practices, and stay engaged in programs over time.

While most program designers would agree that self-interest motivates individuals to alter behavior, why, for example, do we ask farmers to farm more sustainably without the requisite immediacy of reward? Appeals to the long-term benefits of sustainable farming, better for the land, and planet, or sales of crops down the road at higher prices, are weak motivators and easily extinguished.

A more complete grasp of how to motivate individuals near term to achieve desired outcomes is required; and immediacy of tangible reward is a powerful motivator of behavioral change. The goal is to acquire new habits that are more beneficial than old habits, incrementally substituting one behavior for another.

Cognitive behavioral economics (CBE) is the use of program design, behavioral data and tokens/coins herein to reinforce and reward individuals for desired behavioral outcomes. CBE recognizes cognitive elements that are critical to engagement and behavioral practices including framing, problem definition, skill acquisition, frequency of rewards and outcomes. Basically, the human cortex plays a key role----executive function—in framing problems and opportunities; and the mid-brain functions to regulate emotions, for example, feeling good about being rewarded for work accomplished.

The power of ‘framing bias's mentioned above, for example, cannot be overestimated: (a) bank managers perceive that lending money to small-scale farmers is high risk and therefore don’t lend; and (b) that lending to women is higher risk than lending to men, so they deprive women access to capital. Both perceptions are contra indicated by multiple years of data across three continents: commercial loans have default rates equivalent to farm loans, and women evidence lower rates of default compared to men. By using technology, tokens, and behavioral strategies, we can begin to change reality; choices for funding and performance become more data-driven, less determined by faulty perceptions.

BUSINESS CASE:
The single most important mediating link to successful farming outcomes is the farmer. Traditional economic theory and its application in econometrics views the farmer as producer executing yield and profit maximizing behavior. A rational actor in the field. Based on cognitive behavioral economics and its application to a number of disciplines including agriculture, we know that the traditional economic model is highly simplistic and, in many cases, flawed—and its flaws can be costly in the field.

Consider highlights of economic returns utilizing cognitive behavioral management strategies below:

1. Field studies in health, energy utilization, and financial decision making have shown that for every $1.00 spent on ‘nudge behavior’ (positioning statements and

rewards) there is a return of $100.00; or in many studies the returns are in the range of 7X investment. (references below).

4. Field studies in agriculture are equally compelling: for example, reducing behavioral biases of procrastination in farmers including use of fertilizer, amount and timing with seed germination have resulted in rates of return on investment of 70 percent, labor input to output increases of 52-85 percent. Without a designed intervention, procrastination resulted in fertilizer being used as 'top dressing', producing no profitable gains. These studies have been replicated in many geographic regions (references below).
5. The European Union has utilized behavioral design to motivate farmers to enroll their land in agricultural and environmental programs to use less pesticides. A conditional collective bonus was designed and sequenced to drive social expectations of others; it significantly improved levels of farmer enrollment and reduced budgetary costs (references below).

Further development of a solid business case using behavioral and economic assumptions with field applications in beta sites would be highly advantageous to generalization and successful outcomes.

Application for a grant to underwrite our efforts and results is strongly recommended.

THE SCREEN:
Aside from direct program instruction, the proper user interface and mechanism of engagement begin on-screen (UX/UI). The goal is to engage the cortex and mid brain to increase participation and set up the context and key in for rewards. Imagine that you are designing a multi-layered program, manifested on-screen, practiced in the field and subsequently rewarded. On screen includes planning for visual design and neural loops (sequencing and timing between reinforcement for tasks) and use of rewards. Visualization is extremely important. Behavioral prescript outcomes and internalization of practices are goals.

From the perspective of engagement, and adherence it's rather like building a real-life farm game using tokens (external or embedded) to maximize farmer engagement and prescribed behavior. The design
will encourage farmers to look forward to participation.

MVP SCOPE AND FUNCTION:
Following are highlights of MVP components and functions:

(1) **Cryptocurrency wallet**: A cryptocurrency wallet with digital storage in e-mobile App may suffice; or it may be necessary to increase security by utilizing a hardware wallet. Selection of wallet, security, storage and rationale are part of this MVP. Guidelines for selection of wallet type and system are (a) easy—intuitive—for users to access and use, (b) robust security, including resilience, (c) easy and low cost to operate and maintain, (d) energy efficient, and (e) ability to operate internationally, cross-border, including tokens. Critical question for remote areas: Is it

possible to build an off-line mode where connectivity is not available, or extremely slow?

(2) **Wallet Functions**: Whatever the choice of wallet, storage, and security, the wallet will function in four ways: (a) receive, store and utilize money—account functions (fiat currency), (b) receive, and store tokens as rewards for behavior, (c) convert or redeem tokens for value, fiat or in-kind services (d) linkages in place for direct export opportunities, and (d) interoperability with mobile pay, financial institutions and platforms

(3) **Token/coin for rewards**: The MVP will include selection of token, for example ERC20 or Stable Coin, to function as a reward for prescribed behavior, fully convertible into fiat currency or exchange into like value services, for example discounts on mobile phone bill; ability of financial institutions and interested parties to interface with and utilize tokens. Consideration should be given to utilizing a Stable Coin pegged to US dollar. This in itself has explicit value in a volatile currency environment. Rationale for selection of token will be provided.

(4) **Matrix of prescribed behaviors to reinforce outcomes**. The MVP will include development of a Behavioral Matrix that interfaces with rewards and personal account. Core behaviors can be specified to reduce risk, increase sustainably and improve yield. They can be framed as **Preventive, Sustainable and Yield-oriented** behaviors to be rewarded. Rewards designed properly will motivate individuals to perform in prescribed ways; similar to embedded rewards in a video game.

The Behavioral Matrix (desired behavioral outcomes) can be divided into three sections: Risk, Sustainable practices, and Yield. 10-12 key behaviors (or pre-determined optimal number) that account for 80% of desired impact or outcome can be indicated in each section. These behaviors can be indicated and then rewarded with tokens that can be monetized in fiat currency or services. Behaviors must be: (a) simple to grasp, (b) executed in a binary fashion---all or none completion, and (c) measurable.

Sustainability, for example, can be promoted in the form of tokens deposited into a farmers account for completing prescribed behaviors in such categories as water saving activities, improved soil techniques, using fewer pesticides, reduced carbon footprint, using alternative sources of power, appropriate sighting of plants to maximize solar radiation (main determinant of bio-mass), matching of seeds to water supply, and companion planting. This will increase the likelihood of actualizing prescribed behavior.

(5) **Rewards—tokens---dispensed intermittingly change behavior over time**: Despite time lag between such behaviors as planting seeds, harvesting and monetization imagine using tokens as rewards to alter behavior in the field over time: (1) Planting: short term---now to 30-60 days, (2) Growth: mid-term from 60-120 days, and (3) Harvest preparation long term---- 120 days to 12 months from program launch to shipping to market. Structuring rewards delivered over time—process related rewards----will increase behaviors associated with farming efficiencies and sustainability**.**

(6) **Rewards and Reinforcement Schedules:** Using sustainability as framework for example, the MVP will include method and design of timing of reinforcement, which includes prescriptive/framing (joining program, 5 tokens, for example), completion of sequenced behavior (rewards for completing set of 3 of 10 sustainable practices, for example), completion of set of behaviors (reward for completion set of behaviors in program), and intermittent reinforcement, the most powerful of all (rewards for partial completion or special practices, for example,) Behaviors and reinforcement schedule will be clearly defined prior to field testing.

(7) **Entity and method of circulation, redemption and recording of tokens and governance**: The MVP will include a central dispensing and circulation mechanism for rewards; acceptance, exchange, distribution and measurement of sponsorship dollars; determine how will the network and rewards be governed.

(8) **Wired for interoperability including funding sources and financial institutions**: The MVP will be wired, where applicable, for interface to mobile money providers, banks, institutions, foundations and ultimately, direct investment or donor platforms.

(9) **Leader board to feature competition and rewards**: The MVP will include a Leader Board in Phase 2 below: connected to a matrix of performance (identified behaviors of groups) to record performance of farmers in different geographical areas on measured outcomes. This element of competition will be fun and has proven positive results.

(10) **Ability to interface with land registry, yet operate independently**

DESIGN FOR ENGAGEMENT AND REWARDS:

Below are highlights of key design principles to promote user engagement and participation in rewards on screen:

1. **Emotional response action**: Develop a new model of farmer engagement by constructing a neural loop comprised of picture (or video), message, and action, embedded with behavioral reinforcement. Response gradients influenced by rewards are far superior to recall of training.

2. **Locus of control**: Farmers desire having control over what they do and what happens to them. Providing more control leads to more positive associations and outcomes: the more targeted the reinforcement for outcomes that can accomplished, the greater the positive association, retention and involvement.

3. **Engagement reward system**: Farmers are rewarded for appropriate farm behavior. Dispensing content and response are basics for engagement, and better farming. Farmers are integral actors and get rewarded for their contributions, especially for risk prevention and sustainable behavior.

4. **Engagement time frame**: Time frames of engagement are important to plan. Rewards are commensurate with actions including duration between exposure to content (prescribed behavior) and performance.

5. **Engagement through local language and currency**: Local language and currency utilized to promote ease of engagement

6. **Scoring**: A way to keep track of tokens issued and earned

Phased MVP Build Out:

1. The MVP represents an innovative and powerful system for shaping and rewarding small-scale farmer behavior in the field. It includes the best cognitive behavioral principles to shape desired behavior, reward it, and support skill acquisition over time. It features a structured, and applied incentive program to motivate change and expand network effects.

2. New complexities such as resilience of security and accounts, interoperability, cost of system, time to implement, and troubleshooting are of concern. The MVP, to master complexities, can be built and tested in phases, adding features over time. **The first and second phases below need to indicate separate descriptions/functions, costs and timelines.**

3. **Phase one:** (a) translate to local language, where necessary; (b) design and set up technology including system, account, token, and initial security (c) establish method for receiving, storing and dispensing tokens/rewards, (d) set up system to relate behavioral matrix to specific behavioral outcomes and rewards (e) establish ability to record token counts and fiat value, (f) lay groundwork for interoperability, (g) provide calculation in local currency, (h) outline and develop preliminary back-up plant to address and compensate for power outages and surges that may occur; saving data and protecting transmission of data and (i) test simple model with users in field setting.

4. **Phase two**: (a) optimize and re-design based on feedback from users, (b) solidify security and backup of system attributes, (c) design governance and security, (d) open network to organizations or sponsors to place capital or offer services for behavioral rewards, (e) expand use of tokens, (f) establish interoperability with mobile pay, donors and financial institutions (g) set up leader board.

USER PROFILE:

User profile is highlighted below:

6. Average age range of core users is anticipated 40-50 years, although some users will tend to be younger, 25-30 years. This is difficult to know exactly because we don't yet know who will record the requested data.
7. Primarily male. However, gender equity should be planned for and incorporated into design to avoid gender bias
8. Education level US equivalent, 4-6th grade; basic literacy obtained
9. Basic skills with mobile phone
10. Languages: English (Malawi), Spanish (Honduras)

BEHAVIOR PATTERNS SUPPORTING CRYPTO-WALLET:

Emerging payment patterns globally and in targeted countries support use of a crypto-wallet and tokens. According to Global Findex Database, 2018, developed by the World Bank:

1. 69% of individuals have a bank account; 47% of men in Honduras; 39% of women;
2. 25% of people have bank accounts in Malawi, however the rate of opening accounts is growing by 69% annually (Banking the Unbanked, American Economic Journal, 2018, 257-297)
3. Mobile money accounts Honduras, men 10%, women 3% (Statista, 2020); Malawi, approximately 10 percent of the population has mobile money accounts; however, in the near future, The Reserve Bank of Malawi has stated that it wants "most transactions to be done electronically" (Quartz Africa, November, 1, 2018).
4. Payments deposited electronically into accounts include: remittances; wages from government; and private sector payments for work; and payments for agriculture produce sales
5. Agricultural payments in most developing countries are made primarily in cash. However, mobile money accounts are demonstrating rapid growth and are widely accepted.
6. The resistance to acceptance and use of mobile accounts for financial activities is minimal. Based on data of comparable behaviors, the adoption and diffusion of crypto wallets and rewards is extremely favorable to our project.

BENEFITS OF OUR BLOCKCHAIN ECONOMY & REWARDS:

1. **Transparency**: identified participants can be given controlled access to qualified information, which will be important to companies, foundations or individual donors that increasingly require accountability. Deployment of funds is easily subject to verification, avoiding the resistance "how do we know where and how our dollars are being utilized".
2. **Reinforcement of everyday farm activities that further sustainability and reduce risk:** sustainable farming practices and risk management behavior can be rewarded through tokens/coins provided to users. Tokens can be given repeatedly over time to reinforce improvement of farming processes including increased sustainability and efficiency vs. yield outcome alone. Improvement in farm processes is often neglected due to focus on outcomes and yield.
3. **Closing the training gap, improving results**: Our rewards system will help close the training gap between verbal presentation, discussion, practice and delayed rewards based on yield outcomes, which do not happen immediately as crops take time to mature. Leader board recording of competition between people and geographical regions for tokens will encourage game-like participation to win real prize and increased standing. Competition has been demonstrated to work in getting consumers to lower power consumption, for example. Tokens can ultimately be exchanged for fiat currency.
4. **Increased value proposition for farmers**. This can happen in several ways including: (a) developing a group of suppliers and sponsors that will convert coins to fiat credit for supplies or services. Imagine 50 coins of X value rewarded for specific sustainable practices that are converted to cell phone discounts, and/or (b) establishing direct export programs whereby farmers in Honduras, for example, can export coffee directly to roasters utilizing smart contracts to execute transactions. If one acre on a small farm in Honduras can produce say 1,000

pounds of coffee, an increase of 75 cents per pound for direct export will help compensate for existing low prices, thus increasing potential of staying in business, and improving standard of living.

5. **Increased marketing reach**. Tokens such as the ERC-20 invented by Ethereum, for example, have over 50 million unique addresses, with active wallets in the range of 400,000. Airdrops are an inexpensive way of reaching new individual potential sponsors. Whatever token is selected, the user base for sponsor reach, data and institutional connection should be considered.

EVALUATION:

The challenge of this proposal is to design and build an MVP cryptocurrency and rewards system to promote financial inclusion and reinforcement of prescribed behavioral outcomes indicated herein. It will be evaluated for:

1) Creative, best practices to maximize engagement of users and meet objectives
2) Appropriate selection and implementation of key system elements such as type of wallet, token, user interface, behavioral matrix and methods of reinforcement and additional factors to meet objectives.
3) Demonstrated contribution to improving project overall and application
4) System responsiveness geared to adapt quickly to interruptions of power to avoid losing data; promoting ease of recovery
5) Resilience including security, anti-theft and anti-hacking hacking
6) Technical expertise demonstrated in design to utilize less power supply and function in a 3-G or low transmission environment
7) Usability (study) in the field
8) Interoperability within program elements and without to identified participants
9) Deliverables on time and on budget

CONDITIONS OF PROGRAM DESIGN:

Participants in this RFP process need to provide a minimum of two mock-ups of screen design and layout; and allow time for input into the cognitive plan for engagement and behavioral rewards.

REFERENCES:

Anderson school of management, UCLA, business case for nudge behavior, March 28, 2018.

Duflo, Esther, nudging farmers to use fertilizer: theory and experimental evidence from Kenya, American economic review, 2011.

Hartley, MJ., econometric methods for agricultural supply under uncertainty, Science direct, 1983.

Kuhfuss, L. et al., Nudging farmers to enroll land into agri-environmental schemes: the virtues of collective bonus, European review of agricultural economics, October 31, 2015.

Nudge, behavioral economics.com

Tagliabue, M., feeding the behavioral revolution: contributions of behavior analysis to nudging behavior and vice versa, 2018

Thaler, R. and Sunstein, Nudge, Penguin Books, 2008.