

YieldWise Innovation Scan Phases I and II Report for TechnoServe

The Global Knowledge Initiative
YieldWise Innovation Partner
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About this Report:


This report is one of three Innovation Scan reports the Global Knowledge Initiative (GKI) produced in 2016 to support the YieldWise Initiative, a Rockefeller Foundation supported effort to demonstrate a halving of post-harvest food loss in Sub-Saharan Africa. GKI — the YieldWise Innovation Partner — conducted a two-phase Innovation Scan process to address a pressing innovation request from each of the YieldWise Implementing Partners — the Alliance for a Green Revolution in Africa (working to reduce post-harvest loss in Tanzania's maize value chain); PYXERA Global (working to reduce post-harvest loss in Nigeria's tomato value chain); and TechnoServe (working to reduce post-harvest loss in Kenya's mango value chain). In Phase I, GKI investigated possible innovation options and key decision-making considerations. In Phase II, GKI used feedback from the Implementing Partners to delve more deeply into specific innovation opportunities poised to positively impact their ongoing YieldWise efforts.

The following report presents consolidated Innovation Scan findings (Phases I and II) on the innovation request presented by TechnoServe: How might we enhance the traceability of mangoes produced by smallholder farmers in Kenya? For more information on the Innovation Scan process GKI undertook, see Appendix III (p. 26).

Acknowledgements:

Amanda L. Rose, GKI Senior Program Officer and YieldWise Innovation Partner Team Lead, researched and authored this report. GKI Program Officer Renee Vuillaume and Doctoral Fellow Ritse Erumi supported this work.





YieldWise Innovation Scanning
Prepared for: TechnoServe
Prepared by: The Global Knowledge Initiative 2016

Phase I: Innovation Considerations and Options

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Innovation opportunity of focus:

How might we enhance the traceability of mangoes produced by smallholder farmers in Kenya?

Increasingly, companies that source from smallholder farmers and governments that regulate global food trade require traceability along the value chain, from producer to consumer. Traceability offers a powerful amount of data and insight. It offers assurances that value chain actors meet strict market standards for food quality and safety, environmental concerns, trade, and labor. It enables consumers to “see into” their personal food supply chain, if they desire. It can inform efforts to improve value chain efficiency, identify sources of loss, and reward farmers for high-quality production.

With all of these benefits, it should come as no surprise that food traceability is an established field; it is a multi-billion-dollar industry dating back to the 1930's (Setboonsarng, Sakai, and Vancura). However, the use of traceability in *smallholder agriculture* is an emerging, growing innovation space. Traceability in smallholder agriculture presents a host of unique challenges and opportunities that sets it apart from the well-established traceability industry.

Traceability Defined

(per the International Organization of Standardization)

“The ability to follow the movement of a feed or food through specified stage(s) of production, processing and distribution.”

Traceability System Defined

(per the International Organization of Standardization)

“The totality of data and operations that is capable of maintaining desired information about a product and its components through all or part of its production and utilization chain.”

In the case of smallholder mango producers in Kenya, the traceability innovation challenge is less about implementing ever-more sophisticated technological solutions, and more about developing *inclusive, sustainable business models* that improve — not restrict —



market access for smallholders. Indeed, “standards [including for traceability] may act as a barrier to market access for smallholders: the stringent conditions tend to lead to the exclusion of smallholders and the inclusion of larger farmers” (Lemeilleur). One major risk is that “small-scale farmers may lack the resources to comply with increasingly strict food safety standards, particularly traceability requirements” (World Bank). While some success has been achieved in implementing firm-level traceability solutions within smallholder-driven value chains, these successes often remain limited to a small number of farms and farmers. To achieve widespread positive impact, “innovative technical assistance models with the potential for scale-up and cost-effective delivery” and “sustainable business model[s] that can accelerate the widespread adoption of emerging [traceability] technologies” are needed (O’Hara). Indeed, enhanced traceability for smallholder agriculture requires a novel integration of technological, business model, and organizational innovation — an exciting, worthwhile challenge for those willing to engage.

TechnoServe, as a YieldWise Implementing Partner, is particularly well-placed to investigate and trial innovations poised to enhance traceability within the mango value chain of Kenya. Their key roles in aggregating and upskilling farmers, in organizing processors and buyers, in facilitating full value chain efforts to reduce food loss, provide TechnoServe with unique perspective and room to experiment. TechnoServe invited the Global Knowledge Initiative (GKI), the YieldWise Innovation Partner, to support their exploration of the smallholder traceability innovation space. This Phase 1 report presents TechnoServe (and others considering similar investments) with a range of decision-making considerations and traceability innovation options for review. It aims to inform TechnoServe’s understanding of the current traceability innovation space, and tee up our exploration of more specific innovation opportunities in the follow-on Phase 2 Report (see p. 13). The Global Knowledge Initiative (GKI) undertook this analysis as part of our Innovation Scan process for YieldWise, described in brief on p. 26.

Considerations for decision makers:

No “one size fits all” or truly “off the shelf” traceability system exists to fit the needs of smallholders (Lehr). The context is far too important; the stakes are just too high. Instead, there are a host of factors with which decision makers must contend as they develop and implement traceability systems. A few of the most important considerations follow below. These considerations are meant to serve as caution ahead of reviewing the innovation options offered: more value chain and stakeholder analysis is warranted in advance of determining the functions and facets of a traceability system aimed at enhancing market access for smallholder mango farmers in Kenya. The experts listed on p. 24 heavily informed this list.

- 1. Nature and complexity of the value chain.** First and foremost, traceability systems should take into account: the ultimate market destination(s) of the crop; the prevailing standards regimes and traceability requirements of those market destinations; and the segment(s) of the value chain at which traceability is to be introduced (e.g., at the farm; at the first point of aggregation), among other considerations. These standards and requirements should not be taken as hard and fast; the ever-evolving nature of certifications, regulations, etc. necessitates a forward-looking perspective among value chain actors, including smallholders (Wilkins 2016).



- 2. Stakeholder goals for traceability.** When designing a traceability system for smallholder agriculture, it is critical to understand: the major stakeholders engaged (e.g., producers, transporters, buyers, regulators, consumers); those stakeholders' chief objectives for enhanced traceability (e.g., ensure food safety; increase value chain efficiency and business practice; mitigate food spoilage and loss; reward stakeholders for high quality goods; validate sustainability claims; differentiate products in the market); how traceability proponents might integrate these various perspectives and goals; and what type of traceability system (or combination) might best serve the various interests at play (e.g., product segregation; mass balance; book and claim). The following graphic provides brief explanations of these three prevailing traceability approaches.

<p>Product Segregation <i>per the UN Global Compact and Business for Social Responsibility</i></p> <p>"The Product Segregation model implies that certified ... products are physically separated from non-certified ... products at each stage along the value chain ... The Segregation model of Identity Preservation (IP) ... doesn't allow mixing of certified materials throughout the value chain ... The IP model enables the traceability of products back to the originating farm, forest or production site."</p>	<p>Mass Balance <i>per the UN Global Compact and Business for Social Responsibility</i></p> <p>"With the Mass Balance model, certified and non-certified materials can be mixed. However, the exact volume of certified material entering the value chain must be controlled and an equivalent volume of the certified product leaving the value chain can be sold as certified. This is common for products and commodities where segregation is very difficult or impossible to achieve, such as for cocoa, cotton, sugar and tea."</p>	<p>Book and Claim <i>per the UN Global Compact and Business for Social Responsibility</i></p> <p>"In the Book and Claim model, a company can obtain sustainability certificates for the volume of certified materials that it puts into the supply chain. Certified and non-certified materials flow freely throughout the supply chain. Sustainability certificates are bought via a trading platform and can be issued by an independent body."</p>
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- 3. Cost of and incentives for enhanced traceability.** Experts agree: making traceability work for smallholders is not just about the system and tools used, but also about the transaction costs and incentives at play. As such, decision makers must contend a range of factors, including: determining the real costs of implementing a traceability system, including the (non-monetary) transaction costs, resource outlays, and new skills required by smallholders; identifying who will pay for what aspects of traceability in the short and long term; specifying what incentives (e.g., premium payments for high-quality crops, farmers' delivery history as a track record with which to access finance, increased market access and deepened buyer-producer relationships over time) are needed to drive uptake of traceability systems; and understanding what disincentives and risks might slow or thwart uptake. Traceability innovations are evolving, becoming increasingly advanced and comprehensive. Decision makers should take care to appropriately match the sophistication and expense of traceability technologies with value chain needs and opportunities, such that cost and complexity do not overshoot the endpoint (Wilkins 2016).



- 4. Current practices within the value chain.** Experts also agree that successful traceability systems are those that build upon – not supplant – existing business, record-keeping, and communication practices being used in the value chain. This means finding smart ways to integrate traceability tools that map closely to what smallholders, aggregators, and others are already doing. To do this, decision makers must understand existing record-keeping tools and approaches (e.g., paper-based, using Excel files; mobile-phone based), information currently being collected (e.g., farmer data; gross weight transported; delivery dates and times), and available and emerging technological tools that support enhanced traceability amidst existing practices. Indeed, traceability systems are being increasingly integrated with those for farm management, farmer outreach, dissemination of market information, etc. (Wilkins 2016). In this way, it is advisable that decision makers be comprehensive in surveying their information management practices and needs. This will enable them to determine how multi-faceted a system to pursue.
- 5. Contextual fit and smallholder realities.** Innovation does not transform into a solution until it is put in context (Lamb 2016). As such, context is inherent to innovation decision making. Important contextual factors with which decision-makers must contend include: the profile of smallholder farmers to be engaged (e.g., information and communication technology (ICT) literacy, resource base, risk appetite, business/market savviness); mobile phone and other ICT penetration and infrastructure; availability of relevant technologies, including replacement parts and skilled persons to repair them; and the local policy/regulatory environment pertinent to strengthening horticultural value chains, the technology taxation regime, agricultural financing, etc.
- 6. Appetite for collaboration.** The UN Global Compact and Business for Social Responsibility note that “the most successful traceability schemes are multi-stakeholder, involving business, government, and other stakeholders and civil society organizations who have an interest in the sustainability of the said commodity” (Househam et al.). Business-led traceability initiatives feature heavily in the smallholder agriculture space, but traceability schemes that address the needs and opportunities of full industries, sectors, and nations may better address issues related to scalability, sustainability, and inclusivity. In this domain, decision makers must assess: the degree to which stakeholders’ objectives and operational realities align to enable effective collaboration; industry/sector norms to compete versus collaborate on issues of mutual interest; and technical issues pertinent to data sharing and protecting proprietary information.

There are other factors with which decision-makers must contend when implementing enhanced traceability systems, including: data standardization and privacy issues; how to incorporate specific technological assets; timeline and flexibility of implementation; and methods of technical assistance and other forms of support for value chain actors. That said, these considerations reflect a level of specificity beyond the primary considerations listed above.



Summary of innovation options reviewed:

Taking the traceability innovation opportunity and noted considerations into account, GKI offers a brief summary of the most interesting, compelling innovations we reviewed. We present this list not as an exhaustive review of available traceability innovations, nor as a statement of the *only* options TechnoServe should consider. Rather, we present a range of tools to *illustrate what might be possible* in the case of the mango value chain in Kenya.

We ask that readers refrain from viewing these options in isolation. The discrete elements of a traceability system are often packaged into unique *suites* of tools and processes tailored to meet specific market requirements and stakeholder preferences. For this reason, we organize a few case studies of innovative approaches in a matrix, which paint a picture of how different objectives and perspectives might shape the type and emphasis of the traceability system pursued.

Components of a Traceability System:

While the specific features and functionality of traceability systems vary widely, most include the following components. We offer these descriptions both as background to help orient readers to the traceability innovation space and as examples of the building blocks decision makers can consider when developing a traceability system.

Unique identifiers: According to the International Union of Food Science and Technology, “there are many approaches for unique identification of food, many of which are in use throughout the world” (Welt and Blanchfield). Often this involves assigning food products with a Global Trade Identification Number (GTIN) or other identifier, to allow it to be traced throughout the supply chain. Unique identifiers enable supply chain actors to track a crop or other product from its source to various supply chain destinations, including the ultimate consumer.

Data Elements: The types of information or “data elements” that can be captured via traceability systems are growing in step with the sophistication of traceability tools and ICTs. GeoTraceability.com, for example, combines traditional traceability functions with those of a geographical information system (GIS) (Oger et al). Users can track an array of information — on the production process (e.g., agricultural practices used, farmer profiles); the physical environment (e.g., topography, weather patterns); business management practices (e.g., transaction receipts); supply chain management practices (e.g., gross amount and timing of deliveries) — that tell the story of a crop moving from farm to consumer (Ibid.). The question at hand is less about what’s possible (so much is possible!), but about what’s most desired and feasible.

Technology to support identification and data capture: There are a growing number of technologies that can be deployed to enable the identification of crops at various points in the value chain. As noted previously, more often these technologies are leveraged as a suite of tools that contribute to enhanced traceability in complementary ways. The below list highlights some of some of the most oft-used technological tools supporting enhanced traceability:



Barcodes and RFID (Radio Frequency Identification) tags are commonly used to capture and represent unique identifiers and other data elements. Barcodes can be one- or two-dimensional; the former being easy to print and scan, the latter (commonly known as Quick Response or QR codes) being able to account for far greater amounts of information (Slater). DNA barcoding is opening up a new realm of identification possibilities for food products. The molecular-based system allows scientists to identify a particular species by comparing genetic markers against reference sequences, and has been deemed a “universal tool” for food traceability (European Food Information Council). RFID systems offer a “staggering capacity to store data on product attributes,” though in smallholder environments, the cost and complexity of such systems may outweigh the benefits (World Bank). Challenges include: problems with tag identification, limited availability of RFID readers and replacement parts, and a lack of technical expertise and systems integration.

Mobile phone – and increasingly “smart” phone – technology serves as a critical asset for enhanced traceability, especially in smallholder agriculture. These devices are being used to capture and transmit traceability data, communicate with value chain actors, and generally serve as a hub for enhanced traceability. GPS-enabled mobile phones can support efforts to locate and track vehicles transporting products through the value chain, and camera-enabled mobile phones can help visualize and confirm value chain issues pertinent to traceability (e.g., verify sources of spoilage, validate product segregation).

Sensor technology offers expanding capability for real-time tracking of global food supply chains. For example, sensors enable users to have real-time information on motion, temperature, spoilage, and other environmental factors (World Bank). The convergence of sensor technology and nanotechnology is pushing the field forward (Mugadza). Nanotechnology advances are helping to drive down cost of sensor technologies, improve their durability in extreme conditions, and enable the emergence of creative applications such as “smart packaging” (World Bank). Benefits aside, questions of affordability, availability of technical expertise, reliability of the ICT infrastructure, the durability and repair of devices, and other factors loom large (Ibid.).

Information Management System: Efforts to *collect* traceability data become moot without a well-designed information management system to *aggregate, integrate, analyze, and share* that data. The paper-based information management system is very commonly used, but limitations — difficulty checking for human error, conducting higher level data analysis, and sharing information among stakeholders — make such systems sub-optimal for enhanced traceability and supply chain management (World Bank).

Greater possibilities for data integration and analysis, and ultimately for improved decision-making and planning, come with the use of software applications and integration platforms, among other ICT-enabled tools. Software applications and information management platforms are paving the way for a new way of managing information, facilitating communication, and supporting collaboration within value chains dominated by smallholders (Various Experts 2016). Examples include: [FarmForce](#), [Olam's Farm Information System](#), [Virtual City](#), and [M-Farm](#). The choice of which information management software / platform best fits a user's traceability needs is not necessarily straightforward. There is



considerable fragmentation and duplication in the world of “Apps4Ag.” In addition to the decision-making considerations listed above, questions pertinent to data storage infrastructure, long-term system maintenance and improvement, compatibility / interoperability with other solutions and data sources need to be addressed, amid other technical issues (Various Experts 2016).

Aligning Objectives, Stakeholder Perspectives, and Innovation Options:

There are many innovations worth considering when designing a traceability system for the mango value chain in Kenya. As noted previously, the *objectives* of the traceability system and the *perspectives* of the stakeholders engaged in the value chain bear greatly on the way in which innovative tools and approaches might be used to achieve impact. The below matrix highlights a few illustrative case studies, each emphasizing a unique approach / value proposition pertinent to enhanced traceability. These case studies do not present an exhaustive explanation of the approach / value proposition of the featured organizations or companies, nor are these the *only* organization or companies addressing these issues in a compelling way. Rather, they serve as illustrations aimed at sparking creative brainstorming and planning on behalf of TechnoServe and others interested in investing in enhanced traceability for smallholder agriculture.

TRACEABILITY INNOVATION OPTIONS: BY OBJECTIVE & STAKEHOLDERS					
Short-list of objectives for enhanced traceability	Smallholder Producer	Aggregator / Transporter	Processor / Buyer	Consumer	Technical Partner / Donor
Respond in real-time to supply chain inefficiencies e.g., rectify sources of food loss	●	●	●	●	●
<p>Example: Real-time tracking of food through the supply chain</p> <p>GlobeRanger is a RFID software and solutions company that offers pioneering tools and approaches to help customers “move closer to being real-time organizations.” GlobeRangers’ iMotion Platform enables the Internet of Things (IoT) by supporting device and data connectivity and management for RFID, sensors, and other devices.</p> <p>Within the food industry, GlobeRanger solutions “provide real-time track and trace capabilities to enable food companies to monitor the complete harvest-to-market process.” Users also can “monitor product environment in real-time based on user-defined rules concerning temperature, humidity, shock/shake, and/or dwell time” and receive alerts such as text messages or visual displays as issues arise. In this way, the GlobeRanger solutions “provide actionable information so [users] can respond to events <i>before</i> they become problems...[and] pro-actively manage exceptions in real-time.”</p> <p><i>Please note: the use of advanced sensor networks to monitor value chain efficiency and identify sources of food loss may not fully align with the considerations of affordability, contextual fit, and other factors raised above. That said, GKI included this case study as an example of a dynamic innovation</i></p>					



	<i>space pertinent to traceability from which TechnoServe might learn and be inspired moving forward.</i>				
Reward value chain actors for delivering high-quality product	Smallholder Producer	Aggregator / Transporter	Processor / Buyer	Consumer	Technical Partner / Donor
	●		●		●
	<p>Example: Provide premium payments and other incentives to effective producers</p> <p>Building out of work with the Africa Cashew Nut Initiative, SAP developed the Rural Sourcing Management system to support various transactions at the early stages of the agricultural value chain (e.g., from farm to first point of aggregation), which are often overlooked by traditional traceability systems. SAP's Rural Sourcing Management integrates capabilities for value chain management and traceability, with a focus on the many transactions that take place from farm to market. The cloud-based system has three main components: (1) a smart phone application used at the aggregation center, which enables farmers to be registered and log crop purchases; (2) a purchasing platform for buyers / processors that enables payment management, tracking of crop movements and quality metrics, and facilitation of financing; and (3) a survey mechanism that supports field-based reporting.</p> <p>The Rural Sourcing Management offers a range of functionality, including the ability to categorize the type of crop received (e.g., conventional, organic) and distribute premium payments back to producers as relevant. It syncs seamlessly with SAP's Loans Management system, meaning that buyers/processors can apply crop payments to outstanding loans for inputs, for example, rather than cash payments. With SAP's focus on transactions, a farmer's track record of making timely deliveries of high-quality products becomes codified. SAP believes the availability of aggregated farmer data could "open up new commercial models" where production history is used as evidence for access to financing and more lucrative contracts. While questions of sharing personal data loom large, so do opportunities to rethink farmer rewards for delivering high-quality crops.</p>				
Track Good Agricultural Practice (GAP) compliance and target interventions (e.g., training) as needed	Smallholder Producer	Aggregator / Transporter	Processor / Buyer	Consumer	Technical Partner / Donor
	●	●	●		●
	<p>Example: Tailoring GAP training based on farmers' individual results</p> <p>Launched in 2011, GeoTraceability offers "Software as a Service" solutions that are designed to meet the traceability and other needs of stakeholders working with large numbers of smallholders in challenging contexts. The technological solutions used emphasize compatibility and connectivity across data sets and applications, even those that live outside of the GeoTraceability toolset. This interoperability allows users to pull and push</p>				




	<p>data from various sources, enabling a level of flexibility / adaptability critical to operating successfully in resource-constrained environments.</p> <p>For example, GeoTraceability offers a "Program Development" capability that enables users to "tailor sustainability programs and interventions at [the] producer and community level." This could involve tracking a range of socio-economic indicators at the farmer and community level (alongside data pertinent to crop quality and quantity), to assess impact and adapt programs as needed. This capability also could inform efforts to develop tailored curriculum or send personalized text messages to specific farmer groups or individual farmers, based on quality issues identified at the aggregation centers. In this way, program development becomes responsive to specific needs and opportunities on the ground, as informed by a robust data capture and analysis capability.</p>				
Access information about where and how food was produced and processed	Smallholder Producer	Aggregator / Transporter	Processor / Buyer	Consumer	Technical Partner / Donor
			●	●	●
	<p>Example: Providing consumers ready-access to food traceability information</p> <p>Consumer demands for more and better information about the food they eat is one of the drivers of enhanced traceability. Often, buyers have an incentive to address consumers' demand for information, in the name of enhancing brand loyalty and product differentiation.</p> <p>HarvestMark, for example, offers a suite of applications aimed at "connect[ing] with shoppers." Through HarvestMark Connect, the company offers "advanced tools for marketing, shopper feedback, and food safety communication." The HarvestMark Food Traceability App offers consumers novel features such as: a "food safety notification to speed up communication in the event of a recall; A "Talk to the Farmer" feature so shoppers can easily give feedback on the go; a Trace history feature, so a shopper can review previous traces; and a built-in Quick Response-code reader [to further connect shoppers with information on the food they purchase]."</p> <p><i>Please note: the burden of transparency and information access exhibited in this case study may not be realistic or necessary given the complex realities described above. That said, GKI included this case study as an example of a dynamic innovation space pertinent to traceability from which TechnoServe might learn and be inspired moving forward.</i></p>				
Enhance traceability and value chain management capacity at an industry or sectoral level	Smallholder Producer	Aggregator / Transporter	Processor / Buyer	Consumer	Technical Partner / Donor
	●	●	●		●
	Example: Supporting industry-wide traceability through the Better Cotton				



	<p>Initiative</p> <p>The Better Cotton Initiative is a non-profit organization “stewarding the global standards for Better Cotton, and bringing together cotton’s complex supply chain, from the farmers to the retailers.” Their traceability system — Better Cotton Tracer — is recognized as one that takes smallholder realities as a starting point for system design (rather than designing a traceability system that expects smallholders to adapt to it). According to BCI Supply Chain Manager, Kerem Saral, “The Better Cotton Tracer is the most widely-used and the only end-to-end traceability system of its kind in the cotton industry...It is simple, lean and user-friendly, which are the keys for developing a system that could be used by a ginner in Africa, a supplier in Turkey or a retailer in San Francisco with equal ease.”</p> <p>Better Cotton Tracer utilizes SaaS solutions designed and administered by ChainPoint, a company offering software platforms for sustainable supply chains. Using the Mass-Balance approach (which tracks volumes of sustainable product), the system emphasizes continual improvement of practices and processes used in the value chain, rather than compliance with strict standards that may serve to limit smallholders’ market access. Simplicity, flexibility, and alignment with current value chain systems served as leading considerations when designing the Better Cotton Tracer.</p>				
Enhance traceability and value chain management capacity at a national level	Smallholder Producer	Aggregator / Transporter	Processor / Buyer	Consumer	Technical Partner / Donor
	●	●	●		●
	<p>Example: Introducing Kenya’s National Horticulture Traceability System</p> <p>In September 2016, the Kenyan Ministry of Agriculture, Livestock, and Fisheries, in collaboration with the Horticulture Exporters Associations of Kenya and the US Government Feed the Future Initiative, launched an online National Horticulture Traceability System (HTS). The cloud-based system will enable users to track overseas shipments of horticulture crops back to their source, “thus allowing the Kenyan grower to make the corrections necessary to ensure future products meet market standards.”</p> <p>Over the last 18 months, twelve export companies and almost 1500 farmers from 10 counties worked with the Kenyan Government and other partners to develop the system. This effort was undertaken in response to recent challenges faced by Kenyan producers in complying with European Union and other food safety standards. The HTS “includes a mobile app for registering farmers and capturing routine farm operations, a website where stakeholders can share information, and a barcode and Quick Reference (QR) code printing system.” According to recent press statements, “the HTS is unique to Kenya, and customized for a smallholder-based export industry. It can accommodate up to one million farmers.” The system has built-in capability to identify, isolate, and address food safety issues, as well as capture early warnings of pest and disease outbreaks in affected areas.</p>				





YieldWise Innovation Scanning
Prepared for: TechnoServe
Prepared by: The Global Knowledge Initiative

Phase II: Assessment of Available Technologies and Opportunities

Photo: Climate Change, Food Security, and Agriculture via Creative Commons

Phase II Objectives & Selections:

In Phase II of the Innovation Scan, GKI undertook an in-depth look at three traceability innovation options prioritized by TechnoServe, a YieldWise Implementing Partner. TechnoServe selected three traceability software platforms out of those put forward for their consideration in the Phase 1 report: ChainPoint, GeoTraceability.com, and SAP's Rural Sourcing Management. Four main criteria informed their selection:

- **Tailored to address the needs, opportunities, and contextual realities specific to smallholders:** Each of these traceability/supply chain information management platforms was designed to serve sustainability objectives within supply chains characterized by large numbers of smallholder producers. For these three platforms, the smallholder is not an after-thought. They are considered a critical target audience whose needs and interests that inform system design and implementation.
- **Aligned to fit within an aggregation scheme:** Aggregation of smallholders and their outputs serves as a key strategy for reducing post-harvest food loss within the YieldWise initiative. TechnoServe sought to focus on traceability innovation options aligned with ongoing and future efforts to aggregate smallholder mango farmers. Each of these three options meets this criterion.
- **Characterized by a robust supply chain information management infrastructure, beyond traceability:** As TechnoServe delved more deeply into the Innovation Scan process, the ability to integrate multiple information management needs emerged as a priority. While traceability remains the primary focus of this scan, TechnoServe was keen to explore traceability innovation options that exhibit multi-faceted information management capabilities, such as for tracking crop loss, directly engaging farmers to provide feedback on performance, and taking stock of on-farm management practices. As the Comparison Grid on p. 21 indicates, these three options offer traceability as well as a host of other information management functions.



- **Poised for possible pilot in early 2017:** TechnoServe seeks to move forward with their efforts to enhance smallholder traceability in early 2017. As such, they were keen to identify traceability innovation options poised for translation into the mango value chain of Kenya within the next six months. This turned Phase II of the Innovation Scan towards more proven traceability software options (rather than emerging ones), given the organizational infrastructure needed to support a possible pilot in the next 6 months.

Upon initial review, ChainPoint, GeoTraceability.com, and SAP's Rural Sourcing Management emerged as strong contenders for TechnoServe's consideration. Their selection for further review in Phase II, however, should not be taken as an official endorsement by TechnoServe nor The Rockefeller Foundation. Rather, this Innovation Scan Phase II exercise should be viewed as an extension of the investigation initiated in Phase I, which could be expanded to include other candidate innovation options in the future.

In Phase II, GKI reached out to experts at each of these companies to explore the full scope of capabilities and operational requirements of their respective traceability systems. The profiles and comparison grid below present GKI's findings from this process. TechnoServe staff also participated in real-time demonstrations of the three systems led by experts. These demos provided real-time insight into system functionality and usability difficult to communicate in this report.



Traceability Innovation Profile: ChainPoint

Food traceability is a robust global innovation space. Active since the 1930s, it is a currently a multi-billion-dollar industry. However, traceability in smallholder agriculture, especially for perishable crops, remains on the cusp of exploration and experimentation. Understanding which traceability systems are best poised to support sustainability and inclusion in the mango value chain of Kenya serves as a central focus of this innovation scan effort.

ChainPoint: A deeper dive

ChainPoint offers clients a standard, yet configurable software platform designed to meet a variety of supply chain information management needs. Platform functions include traceability, supply chain mapping, monitoring and evaluation, audit and certification, analytics, and storytelling.

Founded in 2003, ChainPoint upholds a flexible approach to supply chain information management, with an eye towards integrating software solutions into existing supply chain practices and minimizing burden on stakeholders. ChainPoint's solutions aim to create simple and easy ways for supply chain actors to get the information they need to collaborate more effectively and sustainably. An open standards interface allows their platform to integrate easily with other information technology platforms (e.g., Excel, SAP), and available hardware (e.g., iOS and Android devices). A modular design allows clients to add and remove functionality on an as-needed basis.

ChainPoint has a growing footprint of engagement and impact across value chains and geographies. Partners include a host of firms and organizations leading sustainability efforts, such as Rainforest Alliance, UNIVeG, the Better Cotton Initiative, and the Round Table on Responsible Soy. They work with thousands of users, which represent millions of smallholder producers, across the globe.

For more information about CP, visit: <https://www.chainpoint.com>.

Key Features:

Innovation Type:

- **Product Innovation:** A combination of different software and mobile applications aimed at flexibly managing supply chain information, including tracing products from their source of origin.
- **Organizational Innovation:** A new way of collecting, analyzing, and using information on crop traceability, farmer activity, and business transactions across the value chain, to inform decision making and planning.

Value Chain Position:

- **Cross-cutting** (from farm or aggregation point, to retail)

YieldWise Value Chain of Focus:

- **Mangoes in Kenya** (Implementing Partner: TechnoServe)

Stage of Operation: (Start-up; Expansion; At scale)

- **Expansion:** Approximately 40,000 users (representing millions of farmers) across the globe use ChainPoint supply chain solutions; they are actively growing the type and number of value chains supported by platform, including further expanding their work with perishables
- **Active value chains:** Their software supports more than 100 sustainable supply chains, including in cocoa, cotton & textiles, palm oil, timber, soy, livestock & feed, fruits & vegetables, and nuts
- **Countries engaged:** Approximately 50 countries, across 6 continents

Pricing Model:

- ChainPoint operates via a **variable license cost model** in which software license fees are calculated based on number of users and they amount of product being monitored in the supply chain. A monthly hosting fee covers data storage. A service level agreement specifies terms of ongoing technical support (charged at an hourly rate).
- Alternatively, ChainPoint can create a **software package** cost model for projects with clear specification and expectations.

Case Study:

Rainforest Alliance is a major non-profit organization working to preserve biodiversity and promote sustainable livelihoods. ChainPoint software supports the Rainforest Alliance Marketplace 2.0, a central repository that enables businesses to trace their products (e.g., bananas) back to the certified farms from which they were sourced. Marketplace 2.0 also helps businesses identify potential suppliers and buyers that adhere to Rainforest Alliance standards, thus helping to expand sustainable sourcing in key supply chains. The Rainforest Alliance-ChainPoint collaboration serves as a way to increase visibility of and accountability in sustainable supply chains, a challenging but worthwhile endeavor.



Comparative Advantage:

ChainPoint's comparative advantage lies in its ability to offer clients both standardization and configurability. The standard ChainPoint platform has been tested and refined over the past decade, in a host of diverse supply chains and environments. Their standardized software platforms can reduce costs and lower risk for their clients. That said, they also work closely with clients to configure their modular software offerings into robust systems designed to meet the needs, and align with the current practices, of specific supply chains. In this way, ChainPoint upholds a unique sweet spot between standardization and customization.

ChainPoint also offers a great deal of flexibility in terms of how it monitors traceability, including the level of rigor that is applied. Within the Better Cotton Initiative, ChainPoint takes a "continuous improvement" approach, using mass-balance traceability of bulked crop as a way to introduce traceability to farmers unfamiliar to the concept of traceability. This means working to achieve some baseline of traceability from which actors can learn and improve from the very start. In other initiatives, such as with the Rainforest Alliance, physical traceability (i.e., tracing products from its farm and producer of origin) was needed to adhere to export requirements. ChainPoint was able to address this more rigorous approach to traceability using its software. ChainPoint's approach emphasizes flexibility and meeting supply chain actors where they are. This helps to eliminate unnecessary uptake barriers that often characterize traceability and information management systems.

Potential for Impact on Post-Harvest Loss:

The YieldWise initiative seeks to enhance the efficiency of key value chains, such that food loss and spoilage is greatly mitigated. Their full-supply-chain approach represents a departure in how post-harvest interventions often are undertaken i.e., compared to isolated efforts at specific points in a supply chain). This approach changes expectations for how value chain actors communicate and collaborate, greatly increasing the need to collect, share, and act upon information gathered across the supply chain. ChainPoint's emphasis on supply chain information management and stakeholder collaboration adheres to this full supply-chain approach undertaken by YieldWise. For example, ChainPoint's pro-active monitoring / warning system stands to help value chain actors avoid food spoilage or loss before it happens. Specific modules for monitoring and clarifying the causes of food loss are similarly poised to add value. For instance, the system can be configured to monitor rejection rates and reasons for them, and identify bottlenecks in the supply chain where persistent loss and spoilage is experienced. These functions go beyond those related to crop traceability, which initiated this innovation scan effort. Taking a broader supply chain information management perspective may enable greater impact on post-harvest reduction than a narrow focus on traceability alone.

A final point: impact on the post-harvest loss challenge has as much – or more – to do with implementation as it does with specific system capabilities. If data is collected, but not used, expected impact will not be achieved. If incentives for system adoption are not aligned with expectations for use, outcomes will be sub-par. Strong leadership for thorough, robust implementation will be needed to achieve the full impact potential. A novel technological innovation, if not put to use, remains but a good (possibly expensive) idea, not an impactful solution.

Degree of Novelty



ChainPoint continually invests in a range of innovative technologies poised to reduce food loss in supply chains. For example, ChainPoint uses advanced sensor technology and predictive modeling to enable real-time responsiveness in supply chains, with the goal of anticipating and avoiding loss.

Strategic Fit



ChainPoint's broader emphasis on supply chain information management (and supporting collaboration among supply chain partners) aligns with the YieldWise full-supply-chain approach (which goes beyond traceability).

Scalability (beyond the mango value chain)



ChainPoint emphasizes vertical (i.e., to handle a growing number of users and data) and horizontal (i.e., to incorporate a growing number of requirements and technologies) scalability. While system configuration may slow scaling efforts initially, ChainPoint's multi-pronged approach to working at scale bodes well.

Adoption Potential



ChainPoint works with local actors – nonprofits, other technical firms – to train system users, and address contextual factors of which ChainPoint staff may not be aware. ChainPoint believes this local partnership approach lowers barriers to adoption that might otherwise hinder implementation.



Traceability Innovation Profile: GeoTraceability.com

Food traceability is a robust global innovation space. Active since the 1930s, it is a currently a multi-billion-dollar industry. However, traceability in smallholder agriculture, especially for perishable crops, remains on the cusp of exploration and experimentation. Understanding which traceability systems are best poised to support sustainability and inclusion in the mango value chain of Kenya serves as a central focus of this innovation scan effort.

GeoTraceability.com: A deeper dive

GeoTraceability (GeoT) integrates multiple software platforms and combines multiple functions to support clients working with large numbers of smallholders, be they farmers, miners, or other types of producers. Founded in 2011 and acquired by Price Waterhouse Cooper in 2014, GeoT combines traceability functions (i.e., tracing goods from farm to point of export) with geo-referenced field data, to create a full picture of how raw material moves through the supply chain, and the conditions under which it was produced. The GeoT system was designed explicitly to serve clients operating in environments dominated by low ICT (information and communication technology) connectivity and limited ICT user literacy. Indeed, GeoT asserts that it is the only software provider that has successfully engaged many hundreds of thousands of smallholders in a physical traceability system running across different commodities and geographies.

Flexibility and configurability serve as two leading characteristics of GeoT systems. Understanding existing transactions and interactions that characterize a supply chain serves as a starting point for GeoT system configuration. For example, GeoT supports *community-level* traceability in cocoa in Ghana, while in Vietnam, traceability begins at the *farm-level* using barcodes to track coffee. In Turkey, GeoT helps track the loyalty of hazelnut farmers, as well as support a range of training programs.

Case Study:

GeoT recently piloted its system to support physical traceability (i.e., product segregation) of palm oil in Malaysia. While large corporations like Unilever and Golden Agri-Resources have achieved traceability at their mills and refineries, physical traceability from the farm-level remains a challenge. Palm oil is highly perishable; palm fruit must be milled within 24 hours of harvest to prevent spoilage. GeoT is one of a few organizations to successfully pilot a traceability solution for palm oil that connects the farm to the mill. Working with partners Wilmar and IDH (the Sustainable Trade Initiative), GeoT is rolling out its system to mills across Indonesia. Key to their initial success has been GeoT's commitment to work with various supply chain stakeholders — farmers, mill operators, buyers — to understand the traceability objectives and their data collection needs, before configuring and piloting the system.

Key Features:

Innovation Type:

- **Product Innovation:** A combination of different software platforms and hardware solutions which integrates traditional traceability support with expanded GIS (Geographic Information System) capabilities
- **Organizational Innovation:** A new way of collecting, analyzing, and using information on crop movement, farmer activity, and business transactions across the supply chain, to inform decision making and planning

Supply Chain Position:

- **Cross-cutting** (from farm or community, to first point of export)

YieldWise Supply Chain of Focus:

- **Mangoes in Kenya** (Implementing Partner: TechnoServe)

Stage of Operation: (Start-up; Expansion; At scale)

- **Expansion:** Currently engaging approximately 180,000 producers and tracing 225,000 metric tons across projects in 13 countries; actively growing the type and number of supply chains supported by platform, including expansion into perishable fruit crops
- **Active supply chains:** Coffee, cocoa, hazelnut, minerals, palm oil, cotton
- **Countries engaged:** Indonesia, Vietnam, Malaysia, Turkey, Kenya, Uganda, Rwanda, DR Congo, Nigeria, Cote d'Ivoire, Ghana, Peru, Ecuador, El Salvador, St. Vincent and Grenadines

Pricing Model:

- Suite of technologies provided as package. **Year One start-up costs** include needs assessment, system blue print and configuration, system installation, and training
- **Ongoing costs** include ICT infrastructure (e.g., data storage), system maintenance and upgrades, and technical support; the ongoing fee equates to roughly 20-25% of start-up costs





Comparative Advantage:

GeoT's comparative advantage lies in its integration of various traceability and geo-referenced field data collection functions, and its commitment to configure software solutions that fit particular supply chains and implementation contexts. Indeed, GeoT goes beyond a streamlined traceability solution, providing clients with a host of other information-based services that support smallholders' efforts to enhance their on-farm management practices, and ultimately their livelihoods. Two of these functions are described in brief below:

- **Digital Agronomist:** This GeoT software platform analyzes field data and agronomic best practice to generate tailored recommendations for farmers. These recommendations are compiled into individual "Farm Business Plans" that can be used target technical support, provision of credit, and other farmer-based services. Through automation, this process can be replicated for thousands of farmers, providing tailored advice on a scale and at a price point not previously possible.
- **Communication with Farmers:** GeoT offers an SMS-based communication platform (provided by technology partner NexMo) that enables project managers and other users to send messages to targeted groups of producers. These messages can be used to inform producers of certain quality issues that surfaced at an aggregation center, for example, and to offer a remedy.

Additionally, GeoT provides a range of technical support, especially at the front of the system configuration process, that positions it for success. GeoT prioritizes the need to understand existing practices and needs within the supply chain before suggesting solutions. Its technical support focuses not only on aligning its system to those practices and needs, but also preparing field staff to implement the configured system.

Potential for Impact on Post-Harvest Loss:

As with other technological innovations, potential impact hinges heavily on adoption among users. A software-based solution may be incredibly well designed and configured. But if its value is not evident to potential users, adoption likely will be an up-hill battle. The value proposition of GeoT for YieldWise implementers and partners is clear: to help identify sources of loss and inefficiency that diminish profits, quality, and other positive outcomes, through increasing visibility and information sharing across the supply chain. However, if GeoT is to achieve wide-spread adoption across the mango value chain of Kenya, the value proposition for farmers must be clear as well. Will farmers, for example, be able to capture premium prices if they participate in a traceability system? Will interactions with buyers and other supply chain actors be more transparent and reliable? All of these outcomes are possible. Indeed, GeoT's system enables buyers, project implementers, and others to monitor and fine-tune their outreach and training efforts. That said, achieving positive impact — for buyers and farmers alike — relies primarily on how the system is implemented (and not necessarily on the system's technological specifications). This is less a question for GeoT, and more so for supply chain actors such as TechnoServe (as a YieldWise Implementing Partner), buyers, and processors who will serve as key stakeholders in system implementation.

Degree of Novelty



GeoT's integration of traceability support and geo-referenced field data offers a comprehensive, unique range of inputs for decision making and planning. The advanced nature of their geo-data collection capability serves as a novel asset.

Strategic Fit



GeoT's commitment to serve clients engaging smallholders, with the goal of increasing visibility and transparency in key supply chains, is well-aligned with the goals of YieldWise.

Scalability (beyond the mango value chain)



GeoT offers a Configuration & Editing platform that enables users to add projects and territories as they go. While system configuration may slow scaling efforts among new users, this capability bodes well for growing its scope & impact among existing users.

Adoption Potential



GeoT utilizes a training-of-trainers approach to sensitize and upskill new users. GeoT maintains that this training support, alongside its efforts to configure the system to match current practice, boosts the potential for adoption among new users.



SAP Rural Sourcing Management

Food traceability is a robust global innovation space. Active since the 1930s, it is currently a multi-billion-dollar industry. However, traceability in smallholder agriculture, especially for perishable crops, remains on the cusp of exploration and experimentation. Understanding which traceability systems are best poised to support sustainability and inclusion in the mango value chain of Kenya serves as a central focus of this innovation scan effort.

Rural Sourcing Management: A deeper dive

SAP is a global leader in enterprise software development, serving over 330,000 clients in more than 190 countries. In December 2016, the company launched Rural Sourcing Management (RSM) as a standard SAP solution. RSM emerged as a custom product (see more below) to capture and support supply chain transactions involving smallholders, an oft-missing piece of the supply chain management story. SAP recognized an opportunity to transform the custom solution into an off-the-shelf software package, understanding that most supply chain software systems miss critical transactions involving smallholders. Their goal is to develop a highly scalable product that is poised to serve the needs of entire markets.

RSM is a cloud-based software system with two main components: a smart phone application designed for use at an aggregation point or processing center to record transactions with farmers; a web-interface platform to track information pertinent to logistics, value addition, quality control. A field survey capability to capture information at the point of production (e.g., on-farm management) also is included in the web-interface. A single phone with the mobile application can serve 100-500 farmers. Mass-balance traceability serves as the standard offering of RSM, though physical traceability can be added as a custom service.

For more information about SAP Rural Sourcing Management, visit: <http://www.sap.com>

Key Features:

Innovation Type:

- **Product Innovation:** A combination of different software and mobile applications aimed at flexibly managing supply chain information, including tracing products from their source of origin
- **Organizational Innovation:** A new way of collecting, analyzing, and using information on crop traceability, farmer activity, and business transactions across the value chain, to inform decision making and planning

Value Chain Position:

- **Cross-cutting** (typically from aggregation point or processing center, to retail)

YieldWise Value Chain of Focus:

- **Mangoes in Kenya** (Implementing Partner: TechnoServe)

Stage of Operation: (Start-up; Expansion; At scale)

- **Expansion:** Approximately 100,000 farmers across multiple pilots currently utilize some version of RSM. The transition to RSM as a standard SAP product points to SAP's sense of growing market demand, and thus opportunity to more widely scale this solution across full markets.
- **Active value chains:** cashew, cocoa, coffee, shea nut, rice, and sesame
- **Countries engaged:** Burundi, Benin, Burkina Faso, Côte d'Ivoire, Ghana, Kenya, Mozambique, Sierra Leone and Uganda

Pricing Model:

- RSM will be available as a standard SAP product in December 2016. Standard SAP products are available for a set service fee, which is calculated based on use (i.e., number of transactions)

Case Study:

RSM grew out of a collaboration with various donors and market actors involved in the Africa Cashew Initiative (ACI), a multi-year initiative aimed at boosting the productivity and incomes of cashew nut farmers in West and Southern Africa. ACI was funded by the Bill and Melinda Gates Foundation and the German development organization (GIZ). SAP's role in ACI focused on developing business software applications aimed at helping farmers bring their cashew nuts to market. Their software solution helped to clarify and structure business processes and information flows between smallholders and major market players (e.g., OLAM, Kraft). Recognizing the gap in software solutions addressing smallholder transactions, SAP set out to further develop its rural sourcing offerings, which have been subsequently been rolled out in numerous pilots across Africa and beyond. Tracing smallholder-produced crops in the supply chain has become a leading feature of the RSM solution.





SAP Rural Sourcing Management

Comparative Advantage:

The comparative advantage of SAP's RSM in part comes from the company's impressive track record in developing and scaling business enterprise solutions the world over. SAP's global footprint and experience in a wide variety of supply chains and business environments sets them apart in this space. RSM is designed to seamlessly integrate with other proven SAP software solutions, such as the Loans Management and Contract Management systems, which are widely used as existing platforms. In this way, users are poised to tap into a broader array of SAP solutions through their use of RSM, which together can serve as a foundation for robust supply chain information management and traceability support.

Additionally, the standardization of RSM as an off-the-shelf software solution to support traceability and other upstream supply chain information needs serves as a differentiator. Traceability experts acknowledge that off-the-shelf software solutions are not currently available for market actors to access on an as-needed basis. Indeed, the need to configure, and reconfigure, systems for each use case can serve as a significant barrier to scaling such software solutions, according to Joel Selanikio, ICT-for-health expert and [Magpi](#) creator. Achieving scale also depends on how useful and simple the system proves to users, which will become clearer for RSM once the standardized software package is available.

Potential for Impact on Post-Harvest Loss:

SAP's roll-out of RSM as a standard software package represents an interesting experiment that could have positive implications for the YieldWise initiative. Ideally, potential users (e.g., buyers, processors, technical support organizations) will be able to self-identify and fund their use of the software, with immediate application in their supply chains. That said, SAP acknowledges that RSM has been designed for use in contexts outside their normal operating environment, namely places characterized by low ICT connectivity and limited ICT literacy among potential users. There likely will be a steep learning curve as SAP rolls out its standard RSM system amidst such contexts.

For example, SAP does not currently have a train-the-trainer approach to support roll-out of the RSM system. Selanikio and others contend that scalable ICT solutions are those that *do not* require training. That said, the multi-faceted functionality of RSM, coupled with the breadth of YieldWise supply chain activities and partner networks, may prove challenging. The integrated, full-supply-chain nature of both the RSM system and the YieldWise initiative ups the responsibility of key supply chain actors (e.g., TechnoServe as a YieldWise Implementing Partner; CocaCola as an anchor buyer) to sensitize potential users and support adoption, in the absence of on-the-ground training support by SAP. This includes developing a sound, comprehensive strategy for how RSM will be implemented, on what and by whom it will be used, and how the information it generates will be integrated into broader decision-making processes. SAP does support general system set up and implementation of the organizational hierarchy, though self-guided learning and experimentation among implementing teams should be expected.

Degree of Novelty



According to experts, SAP's RSM will be the first widely-available, off-the-shelf traceability system available designed that was specifically designed to address a variety of smallholder transactions in supply chains.

Strategic Fit



The scope and functionality of the RSM system align closely with the YieldWise initiative goals to boost supply chain efficiency and effectiveness. It is less clear how well the system can address more granular data needs pertinent to food loss, given its standardized nature.

Scalability (beyond the mango value chain)



Of the three options included in this scan, the RSM system has the highest potential for scalability given standardization, but only if other characteristics such as usefulness and ease of use are similarly upheld. As noted, this experiment in standardization is just beginning.

Adoption Potential



Limited evidence regarding the newly standardized system's ease of use make it difficult to ascertain whether the lack of on-the-ground training support will prove a large barrier to adoption or not. Time will tell how well this system is aligned with the contexts and users for which it was designed.



Comparison Grid: A Side-by-Side Look at Traceability Innovation Options

The following table provides a brief overview of key functions and characteristics of the three traceability innovation options explored in this Phase II report. While not comprehensive, these system attributes correspond to those prioritized by TechnoServe.

	ChainPoint	GeoTraceability.com	SAP's RSM
Key Function			
Traceability (trace back the origin, quality, quantity)	X	X	X (mass-balance as standard)
Field data collection (e.g., farmer data, on-farm practices)	X	X	X
Geospatial and environmental data collection (e.g., soil samples)	Basic capability (more advanced through third party)	X	Through third party or other SAP system
Supply chain mapping	X	X	X
Audit and certification	X	Through survey function	Through other SAP system
Monitoring & evaluation (e.g., of supply chain performance)	X	X	X
Smallholder SMS communication	X	X	X
Training & knowledge sharing (e.g., tailored business plans)	X	X	Data collection only
Inputs and credit management (e.g., fertilizer, seed)	Through third party	X	Through other SAP system
Mobile payment management	Through third party	Through third party	Through third party
Contracts management	X		Through other SAP system
Information sharing across supply chain	X	X	X
Ongoing supply chain monitoring; pro-active warning system	X	X	X
Verification of sustainability claims	X	X	X
Reporting and supply chain analytics	X	X	X (Via management platform)
Storytelling (i.e., transforming data into compelling narrative to support decision making)	X (business to business, & business to customer)	X (via User Story function)	X (Via management platform)



Key Characteristic			
Language	English, German, French, Spanish, Chinese, Russian	English, French, Spanish	English, French, Spanish, Portuguese
Flexible / Configurable	X	X	Off-the-shelf; customizable upon request
Hardware	Mobile device, tablet, desktop	Mobile device, tablet, desktop	Mobile device, desktop
Data storage	Hosted or cloud-based	Cloud-based	Cloud-based
Estimated time to start-up	6+ weeks, depending on needs and system configuration	6+ weeks, depending on needs and system configuration	4+ weeks
Cost structure	Variable license agreement + technical support	Set up fee + ongoing fee	Service fee, based on use (i.e., transactions)
Ongoing technical support	X	X	X
Support for project staff during pilot / rollout	X (system set up and training)	X (system set up and training)	X (system set up)
Build off existing processes, data infrastructure	X	X	
Push / pull data from other information systems	X	X	X
Operate off-line, and sync when online again	X	X	X
User-friendly dashboard for customized reporting	X	X	X (Via management platform)
Experience in fruit crops	X		

(Matrix design informed by colleagues at RTI International)



Conclusions and Next Steps:

The goal of this innovation scan process was to support TechnoServe (and others in similar positions) consider the many factors, and weigh some high-potential options, for improving traceability in supply chains dominated by smallholder producers. Indeed, the innovation space for smallholder traceability remains open, since most proven systems fail to capture and support smallholder transactions, while others have failed to sustain their efforts beyond pilot stage. The three options explored in this Phase II report are making important strides in bridging this gap. Each offers particular advantages that would serve the YieldWise initiative and its ambitious goals.

That said, the questions ahead largely are those for TechnoServe and its partners (including its anchor buyers) to address. The success of a traceability pilot (and later, the full rollout) hinges not just on the technology selected, but on the strategy TechnoServe and others take to support implementation and adoption among supply chain actors. Choosing the “right” technology does not guarantee impact, not by a long shot. Careful consideration of existing practices, user preferences, value chain requirements, and other factors is warranted. Generating buy-in and support from TechnoServe's wide range of partners involved in YieldWise — anchor buyer CocaCola, local processors, farmer groups — serves as another key need. While a seemingly high bar, this work is doable and worthwhile, as demonstrated by the multiple use cases offered in this report.

GKI hopes that this Innovation Scanning process serves as a valuable input into TechnoServe's decision-making process. We welcome the chance to discuss these findings and recommendations with the TechnoServe team when convenient.



Appendix I: List of Experts Consulted

It is with sincere thanks that GKI acknowledges the following individuals and their contributions to this Phase II Innovation Scan report:

- Pierre Courtemanche, Chief Executive Officer, GeoTraceability.com
- Peter Derksen, Marketing Communications Manager, ChainPoint
- Elizabeth Eckert, Sr. Food and Agriculture Specialist, RTI International
- Alexander Ellebrecht, Business Development Manager, ChainPoint
- Momen Elleuch, Project Manager, GeoTraceability.com
- Carstend Friedland, Senior Researcher, SAP SE
- Isaiah Kirema, YieldWise Initiative Lead, TechnoServe
- Annah Latane, Food Security and Agriculture Specialist, RTI International
- Tanja Reith, Solution Manager, SAP SE
- Fidel Wambiya, Markets Expert, YieldWise Initiative, TechnoServe



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Appendix III: Background on the YieldWise Innovation Scan

The global agricultural innovation landscape is vast. Actors continually generate new ideas relevant to the challenge of reducing post-harvest food loss in Sub-Saharan Africa. There is much to learn, adapt, and apply from other industries and sectors. Staying abreast of innovations opportunities requires an ongoing, purposeful scanning mechanism. As the YieldWise Innovation Partner, the Global Knowledge Initiative (GKI) scans for **adjacent innovations** poised to add near-term value to YieldWise, as prompted by innovation requests submitted by Implementing Partners and The Rockefeller Foundation. In this way, GKI will serve as a dedicated “innovation prospector” for YieldWise.

GKI also will run an innovation scan to explore **transformational innovation** possibilities that signal potential to bring about wide-spread impact within the field of post-harvest food loss, and agricultural development more broadly. Beginning in early 2017, GKI will run a series of future-oriented innovation ideation workshops and conduct exploratory research into game-changing trends and opportunities. Thus, our full innovation scanning process will enable YieldWise and its Partners to explore innovation from two distinct but complementary perspectives: adjacent and transformational innovation.

Adjacent Innovation Defined

Pursuing “new to the organization” tools, processes, etc., that push organizations to put their core capabilities to new use.

Transformational Innovation Defined

“Developing breakthroughs and inventing things for markets that don’t yet exist.”

(per the *Innovation Ambition Matrix*)

Innovation attributes guiding our scanning process:

Why does the distinction between adjacent innovation and transformational innovation matter for our scanning process? Namely, they are characterized by different attributes, which propel the scanning process in distinct directions. Transformational innovations, for example, “cause far-reaching changes, affect several branches of the economy, and give rise to entirely new sectors” (Scrase, Stirling, and Geels). Examples of transformational innovations include self-driving vehicles, Internet-of-things technology, 3D printing, and others. These game-changers rarely come along, but when they do, we feel their effects quite dramatically.

Adjacent innovations are distinct from transformational innovation in ways that matter a great deal for YieldWise; they likely will feature more heavily than the rare-but-high-profile transformational innovation in the efforts of YieldWise Implementing Partners. Adjacent innovations align with and build on current practice in an organization, industry, or sector. For example, they are those innovations that readily map to the strategic objectives of YieldWise, and have potential to impact Partners’ stated requests. Given the unique environments in which the YieldWise Implementing Partners work, attributes such as affordability, feasibility,

Attributes of Adjacent Innovation to guide scan

- Alignment with current practice
- Affordability
- Feasibility of use given prevailing conditions
- Sustainability
- Strategic fit within YieldWise
- Potential for impact on Partners’ stated need



and sustainability also featured heavily in GKI's adjacent innovation scanning process (OECD).

Innovation opportunities of focus:

In this first round of scanning for adjacent innovation opportunities, GKI sourced requests from YieldWise Implementing Partners as a starting point. Each of the Implementing Partners — the Alliance for a Green Revolution in Africa (working to reduce food loss in Tanzania's maize value chain); Pyxera Global (working to reduce food loss in Nigeria's tomato value chain); and TechnoServe (working to reduce food loss in Kenya's mango value chain) — presented a single, pressing innovation request. These requests — and the innovation opportunities they represent — are described in greater detail in the following pages. In summary, the innovation requests focused on the following issues:

- For the mango value chain in Kenya: ***How might we enhance the traceability of mangoes produced by smallholder farmers in Kenya?***
- For the tomato value chain in Nigeria: ***How might we best support Nigerian smallholder farmers who want to dry tomatoes as a secondary market opportunity?***
- For the maize value chain in Tanzania: ***How might we leverage information and communication technologies (ICTs) to scale extension and training solutions that support behavior change among smallholder farmers?***

On the surface, these requests might seem quite dissimilar. But once you unpack them, common themes and issues emerge, which point to the core objectives of the YieldWise initiative. Indeed, each request directly connects to broader YieldWise priorities, such as:

- How might we ensure large buyers are able to source locally and sustainably from aggregated smallholder farmers? (Intermediate Outcome, M&E Framework)
- How might we help smallholder farmers meet the quantity, quality, and consistency of requirements of buyers? (YieldWise Strategy Component)
- How might we support targeted innovative technologies in specific value chains? (YieldWise Strategy Component)

GKI's process for Innovation Scanning:

Upon receiving the Innovation Scan requests from YieldWise Implementing Partners, GKI held a series of consultative conversations with the Partner teams and The Rockefeller Foundation to clarify the requests, gather background, and understand Partners' objectives for the scan process. Our team then undertook a thorough analysis of the "challenge space" represented by each of the requests. We took a broad view of the issues raised by Partners in an attempt to not preordain a particular innovation / solution path. We analyzed the issues from various perspectives; reviewed a diverse set of resources; and spoke with experts knowledgeable in the value chains and challenge areas of focus. We pushed our team members to reframe the requests provided, such that the true drivers of change were put front and center.

Why such an emphasis on understanding the challenge space? In the YieldWise value chains and countries of focus — where smallholder farmers dominate production, operating conditions are tough, and technology adoption is often an uphill battle — translating innovation into impact is as much (or more) about context and incentives for change, as



about the technology. Without a clear understanding of the many factors at play — socioeconomic, cultural, political, geographic, market-based, educational — innovation-led initiatives tend to fall short of their goals. Worse, such initiatives can divert precious resources away from the very real, yet unglamorous, work of incremental progress being made on farms, in aggregation centers, and in processing facilities within YieldWise on a daily basis. For these reasons, GKI presents “considerations for decision-makers” for each of the innovation requests. These serve as our attempt to lay out some (though not all) of the most important factors bearing on the effectiveness of innovation-led initiatives.

In Phase I, our team honed in on particular innovation options that offer interesting, compelling ideas for each request and also account for the “considerations for decision-makers”. The innovation options look a little different for each challenge, and thus are presented in a slightly different format. These options were not meant to be exhaustive, nor are they fully elaborated in this report. Rather, they represented a starting point for brainstorming and further contextual and stakeholder analysis, in which GKI supported the YieldWise Implementing Partners in Phase II of this Innovation Scan.

Looking ahead, GKI will share this report with our YieldWise Implementing Partners and The Rockefeller Foundation. Then we will co-design next steps with Partners. This may involve follow-on conversations with proponents of the innovation options; or additional steps that work best for our Partners. We aim to align our process to the decision-making needs and timelines of our Partners, and thus welcome their close collaboration as we move forward.

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