smallholder farmers alliance

Columbia SIPA Capstone Project

Scaling a Successful Social Enterprise Model in Haiti

Spring 2018

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Agenda

- **Setting the Stage: *Overview of SFA***

- Cotton in Context: *Certification Landscape & Requirements*

- Best Practices in Data Management: *Agribusiness Case Studies*

- Recommendations: *System Architecture, Technology Solution, Innovative Expansion*

- Executive Summary

SFA is a non-profit organization aiming to apply a social enterprise model to promote agroforestry

SFA Today

Timberland's Challenge

5 years, 5 million trees

GRANT

Outcomes

- **6+ million trees**
- **3,000 farmers**
  - **40% ↑ crop yield,**
  - **50% ↑ household income**

SFA's focus has centered on upstream agroforestry production…

Current Value Chain

Farmers plant trees…

…in exchange for agricultural inputs…

seeds   tools   training   microfinance

Farmers
(3,000)

…allowing them to grow crops for food and income

…but now aims to close the loop by connecting smallholder farmers in Haiti directly to global markets
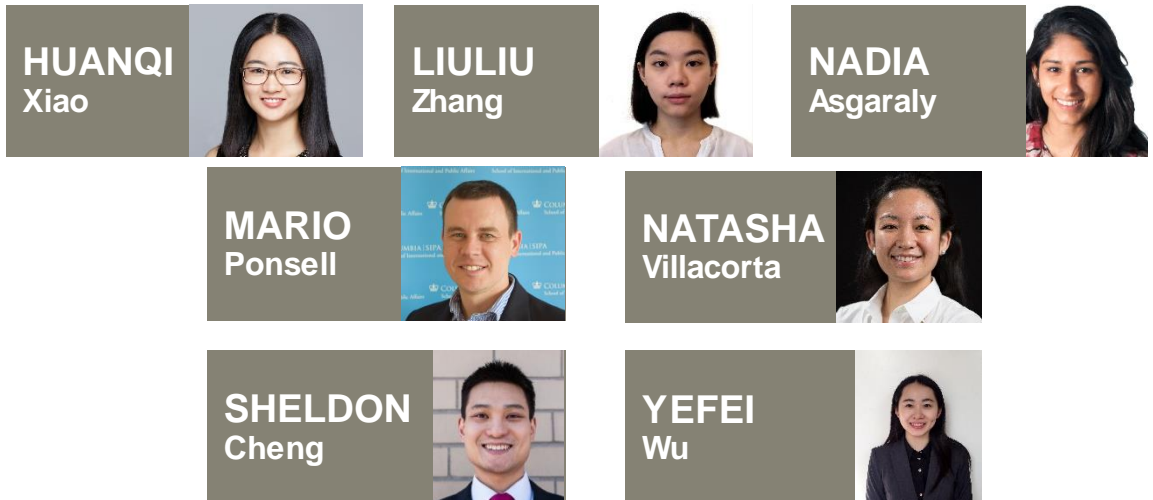
Future Value Chain
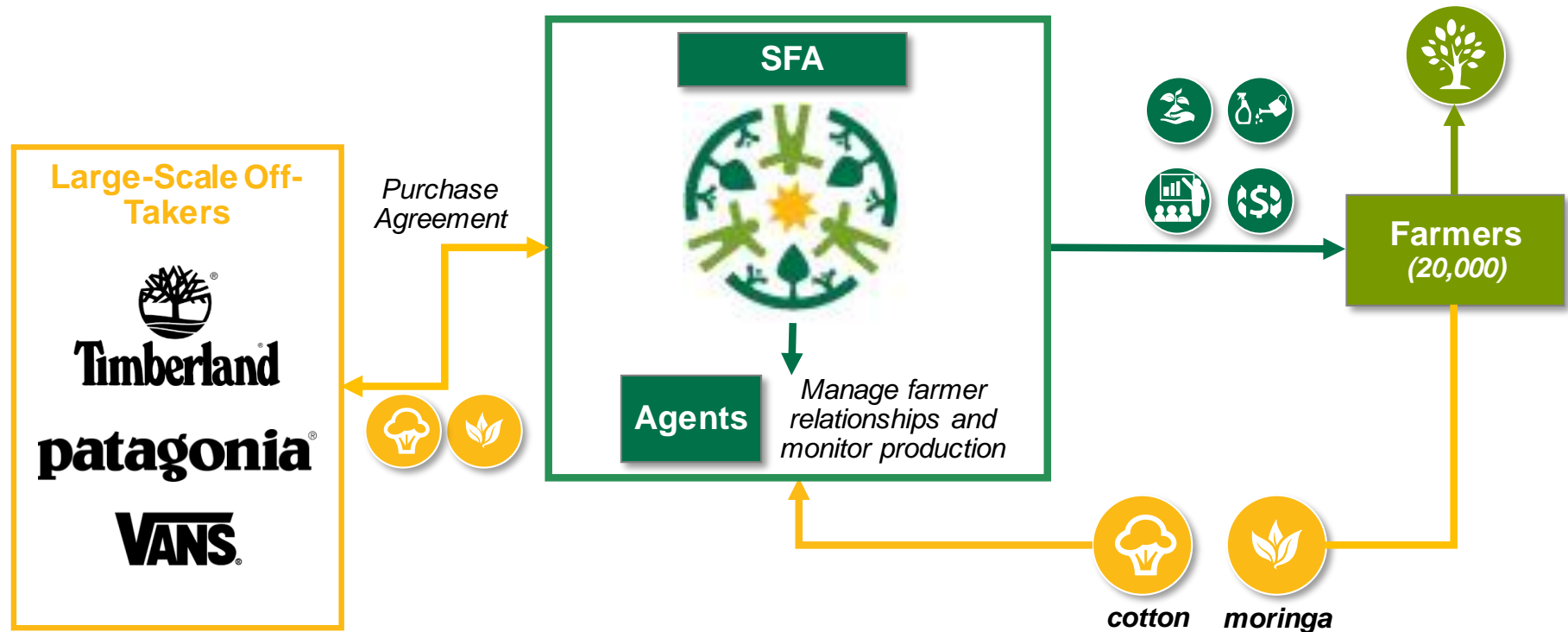
SFA is seeking to substitute grant funding with margin on trades (purchase agreements) to sustain activities

Through its partnership with CO2 Logic, SFA has commissioned a cross-functional team of graduate students…

Columbia SIPA Team

HUANQI
Xiao

LIULIU
Zhang

NADIA
Asgaraly

MARIO
Ponsell

NATASHA
Villacorta

SHELDON
Cheng

YEFEI
Wu

Areas of Expertise:
- Database management
- Supply chain and logistics
- Public-Private Partnerships
- Monitoring and Evaluation
- Microfinance & Smallholder farming
- Financial and industry analysis
- Business and strategic planning

…to design a data management system to transform its value chain while demonstrating innovation in smallholder traceability

SFA "Ask"

Recommend a unified data management system capable of:

1 **Farmer Management**

Tracking farmer-level performance and quality

3 **System Cohesion**

Providing robust analytical data to empower SFA decision-making

2 **Traceability**

Meeting client volume and traceability requirements

4 **Innovation**

Delivering an innovative, but tangible solution for smallholder farmers

Our team has established a few areas of focus and plan to follow a clear process…

Approach

4 Research Areas

Agribusiness Data Case Studies
- Understanding of successful business models allows us to replicate them successfully
- Industry standards and/or 'best practices'

SFA Business Requirements[1]
- Understanding of what information SFA needs to track
- Farmer production yield and quality, agent efficacy, credit and microfinance

Offtake Requirements
- Different offtake will have different requirements
- Traceability, certifications (e.g. organic), lead time and delivery performance

Software and Technology Options
- Understanding of the various types of software and technology solutions already in use
- Industry standards and/or 'best practices'

5 Step Process

- Research
- Preliminary Hypothesis
- Solicit Feedback
- Refine Recommendation
- Finalize Recommendation

1. Includes supply chain and inventory management, finance, farmer information

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The outlook of Haitian commodity cotton requires a glimpse to the past to make assumptions about the future

Haiti and Cotton: Columbia | SIPA Insights

Cotton futures fluctuate based on many factors:

Macro Influencers

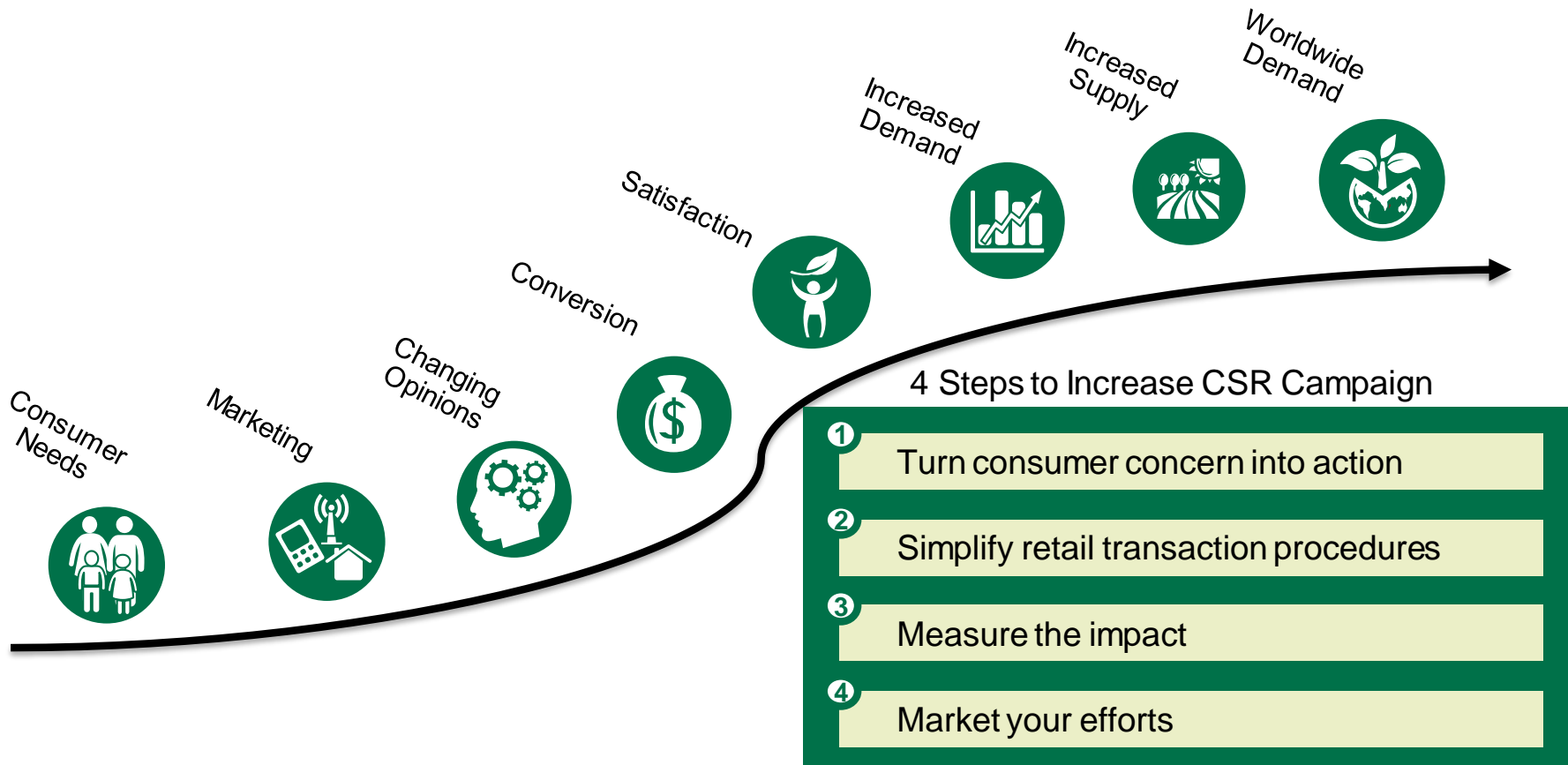| Global Demand | Sustainability Trends | Weather Patterns | Climate Change | Geopolitical Trends |

Cotton Futures (2008-2018)

March 2011:
Increased Chinese demand sends futures to record high of $210.64 / pound

11

Prices, trends, and demand for organic cotton depend on the ability to market its social and environmental responsibility

Consumer Needs

Marketing

Changing Opinions

Conversion

Satisfaction

Increased Demand

Increased Supply

Worldwide Demand

4 Steps to Increase CSR Campaign

1. Turn consumer concern into action
2. Simplify retail transaction procedures
3. Measure the impact
4. Market your efforts

Adequate supplies of organic textiles are a continuing challenge despite a 9% increase in sales to $3.9 billion in 2016

Cotton Processing Steps

BETTER COTTON: SEED TO STORE

Better Cotton seeks to make cotton more sustainable throughout the growing process — for the planet and the farmers who produce it.

1. TRAINING Non-profit organizations provide culturally relevant farmer training in key cotton regions.

2. PLANT Cotton seeds are planted alongside other crops to provide a habitat for beneficial insects. Border crops help in the reduction of harmful pests.

3. GROW Farmers use less water and focus on protecting key soil nutrients.

4. HARVEST As cotton is picked and harvested, trash, contamination and damage are minimized.

5. GIN In the gin, the cotton is dried, cleaned, and compressed into bales. Better Cotton is given a tracking number.

6. MILL Cotton bales are spun into yarn, dyed and woven into fabric. Fibers are tested for quality standards.

7. PRODUCT Levi Strauss & Co. is blending Better Cotton into 2 million pairs of our jeans around the world.

DID YOU KNOW?
- Cotton is grown in more than 80 countries
- Cotton is cultivated and farmed by about 300 million workers.
- Cotton is the largest non-food crop in the world.
- Cotton ranks third in pesticide use, behind corn and soybeans.

CAN WE MAKE IT BETTER?
- Better Cotton is better for:
  - the people who produce it
  - the environment it grows in
  - the cotton sector's future

BCI | LEVI STRAUSS & CO.

Cotton Lifecycle
1. **Farmer Training**
2. **Plant**
3. **Cultivation**
4. **Harvest**
5. **Ginning**
6. **Manufacturing**
7. **Retail**

Until organic cotton can be produced at scale with full traceability, it should be sold close to non-organic cotton prices

The threats to organic cotton are global, non-organic certifications that implement full lifecycle traceability

Cotton Certification Standards and Resources

Non-Organic

Certified Organic

There are no certifications that meet all SFA's guidelines, but data collection can clearly go above and beyond requirements

Certification Standards Matrix

	Cost	Individual Tracking	Farm Tracking	Chain of Custody	Digital Tracking	Claim Marketing Standards	Detailed Audits	Synthetic Chemical-Free
USDA ORGANIC	Up to $6000		✓	✓		✓	✓	✓
BCI	Volume Based	✓	✓	✓		✓	✓	
GOTS	Up to $8000					✓	✓	
COTTON MADE IN AFRICA	Volume Based	✓	✓	✓	✓	✓	✓	

CMiA Standards – HIP meets all of SFA's non-organic requirements for traceability

IDENTITY PRESERVED: COMPLETE TRANSPARENCY ACROSS THE CHAIN

The Hard Identity Preserved system (HIP) offers complete transparency throughout the entire textile value chain. Cotton can be completely tracked the entire way from the cotton field to the finished product. For this to occur, all those involved in the textile chain must input the relevant information in a database. Precise information about the origin of the raw material up to the growing area can be communicated.

MASS BALANCE CHECK AT THE SPINNING MILL

Normally the spinning mill serves as the link between the licensee's supply chain and that of the licensor for sourcing. Under the material balanced system, quantity control is undertaken at the spinning company level. An online tracking system developed for Cotton made in Africa monitors the amount of cotton bought and compares this with the amount of yarn sold with the Cotton made in Africa label. The spinning mill informs us about inflows and outflows of stock. The system works similar to the one used in green electricity.

USDA Organic: Responsibility for compliance falls on the farmer/co-op and must be renewed annually

Steps to Initial Certification

1. Adoption
2. Application + Fee
3. Paper Audit / Review
4. On-site Inspection
5. Reconciliation
6. Certification Issuance

Steps to Certification Renewal

1. Renewal Fee
2. On-site Inspection
3. Reconciliation
4. Certification Issuance

Figure 1: The Organic Certification Process

Producer or handler adopts organic practices; submits application and fees to certifying agent

Certifying agent reviews materials to verify that practices comply with USDA organic regulations

Inspector conducts an onsite inspection of applicant's operation

Certifying agent reviews the application and the inspector's report to determine if the applicant complies with the USDA organic regulations

Certifying agent issues organic certificate to applicant

Annual Recertification Process

Certifying agent reviews the application and the inspector's report to determine if the applicant still complies with the organic standards

Inspector conducts an onsite inspection of the applicant's operation

Producer or handler provides annual update and fees to certifying agent

Inspectors look at a wide variety of systems and control points on the property and in the production lifecycle

Land requirements

Soil fertility and crop nutrient practice standards

Seeds and planting stock practice standard

Crop pest, weed, and disease management standards

Wild-crop harvesting practice standard

Commingling and contact with prohibited substance prevention practice standard
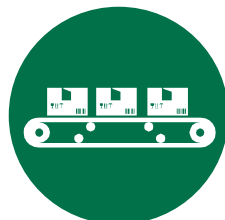
Facility pest management practice standards

Processed, organic fibers can only be tracked back to organic farming practices using meticulous record keeping

Key takeaway: A **disciplined approach** to data collection and analysis **can prevent noncompliance** and potential adverse action that jeopardizes new or ongoing certification status

	Penalty Matrix			
	Minor Issues – Conditions for New or Continued Certification	**Notice of Noncompliance (NONC)**	**Major Noncompliances – Denial or Proposed Suspension of Certification**	**Major Noncompliances – Denial or Proposed Revocation of Certification**
Violation	➤ Noncompliant practices that: • Indicate no systemic failure[1] in OSP design or implementation *and*; • Can be easily corrected without the need for a corrective action plan.[2] ➤ Minor inconsistencies or omissions in records that: • Indicate no systemic failure in OSP design or implementation *and*; • Can be easily corrected without the need for a corrective action plan.	➤ Noncompliant practices that: • Indicate no systemic failure in OSP design or implementation *but*; • Are significant enough in nature or in scope to require a corrective action plan to ensure and verify compliance. ➤ Inconsistencies or omissions in records that: • Indicate no systemic failure in OSP design or implementation *but*; • Are significant enough in nature or in scope to require a corrective action plan to ensure and verify compliance.	*Proposed Suspension* ➤ Failure to resolve, successfully or within a prescribed time period, a previously issued noncompliance. *Combined Notice of Noncompliance and Proposed Suspension* ➤ Systemic failure of OSP design or implementation that demonstrates inability to comply with the regulations. ➤ Accidental or otherwise un-willful application of a prohibited substance to land.[3]	➤ Deliberate violation of the regulations, including: • Willful sale, labeling or representation of conventional agricultural products as organic; • Willful sale, labeling or representation of agricultural products as organic in violation of the regulations; • Willful application of prohibited substances or use of prohibited practices. ➤ Falsification or concealment of records. ➤ Refusal to provide access to a unit, facility or site for inspection[4] or access to records applicable to organic operation. ➤ Continuing noncompliance with the regulations following a proposed suspension.

Source: USDA Organic Regulation Enforcement Standards

Timberland/VFC is primarily interested in traceability and ROI

Timberland and VF Sourcing History

- Cotton is only sourced from US, AUS or other locations with specific sustainability schemes - organic, fair-trade, etc.

- Most cotton sourced is from Better Cotton Initiative

- Organic and fair-trade ends up costing 2x pricing

- Planned commitment to Haiti is small in larger VF cotton sourcing (5,000 MT of total annual 200,000 MT purchasing)

Unless there is a compelling financial case, reconsider pursuing organic certification

1 Traceability is the key driver of commercial interest

2 Consumer interest driven by marketing and advertising

3 Alternative sustainable certifications may provide better ROI

4 Hard Identity Preserved (HIP) system employed by CMiA would meet all non-organic requirements

5 Pursue organic certification only if buyers are willing to pay premium

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- Recommendations: *System Architecture, Technology Solution, Innovative Expansion*

- Executive Summary

To help inform SFA's path forward, we have assembled 6 case studies in agribusiness

Agribusiness Case Studies

ONE ACRE FUND

Food and Agriculture Organization
of the United Nations

myAGRO

SMASH Mobil

AGRA
Growing Africa's Agriculture

Chetna Organic
Environment..Ethics..Equilibrium

Approach

- Identify leading organizations working in agriculture and/or with smallholder farmers

- Ascertain best practices in data management by focusing on:
  - Understanding unique **organizational context and mission**
  - **Approach** to data management
  - **Technology platforms** used
  - Key **success factors**
  - **Lessons learned**

Implement data management system in phases based on org's maturity

ONE ACRE FUND

Estimated cost: $$

Situation

- **Purpose:** One Acre Fund (OAF) works with smallholder farmers in East Africa, providing them with financing and agricultural training and inputs
- **Scope: 400,000 farm families** in **six countries**
- **Impact:** increasing farmer's income by **over 60%**, over **97% repayments** on their loans, and approximately **70% of their operations are financed by these loan repayments**

Technology and Approach

- **Functions**: farmer management, logistics, inventory management, performance monitoring
- **95% paper system**
- **Software used**: **Commcare** for M&E analysis, field-facing data collection on paper, **custom MS Access** for back-end database, **Excel and SAP** for logistics
- OAF distributes farming inputs, conducts farmer training, and monitors farm yields and farmer income

Key Takeaways

- OAF's data management system is **very robust and comprehensive**
- Even still, it is still **95% paper based collection with data entry afterwards**
- OAF has used various types of software in its development
- **High staff per farmer ratio:** 1 to 80

Implications for SFA

- **The correct data management system depends on the stage of development of the organization**
- **Phased implementation:** it took OAF 1 year to switch/implement solutions
- SFA needs to **hire more staff** to achieve goals
- **Qualifications and skills** of the team are important.
- OAF struggles to manage data even without closing the loop

Digitization can be difficult and takes time

Food and Agriculture Organization of the United Nations

Estimated cost: $$$

Situation

- **Purpose:** targeted "smart subsidies" using **e-vouchers** coupled with a participatory agricultural extension approach
- **Scope:** eleven districts of four provinces in Mozambique
- **Impact:** e-Voucher **increased yield** from maize from an average of **0.82 ton/ha** to an average of **2.6 ton/ha**

Technology and Approach

- **Functions**: farmer profile information, payment information
- **Software used:** custom-built by NEC
- Required specific equipment, such as solar panels to generate power for the tablet and card reader, plastic card for the farmers
- Farmers use e-Vouchers to purchase farming inputs from specified agro-dealers

Key Takeaways

- Use of a **pin code and photo** for security
- **E-voucher (card)** transactions work as records of **value and amount**
- First step of financial inclusion

Implications for SFA

- Even relatively lower technological solutions will **require modifications** to work in remote areas
- Required **one full season** to implement pilot

Building farmers' trust is essential when introducing new technology or processes

*my*AGRO

Case Study (3 of 6)

Estimated cost: $$

Situation

- **Purpose:** award-winning NGO focused on poverty alleviation through a mobile (bank-less) savings platform for smallholder farmers
  - Founded in 2012 in Mali
- **Scope:** 34,000 farmers in Mali & Senegal (as of 2017)
- **Impact:**
  - 50%-100% increase in harvest yield
  - $150-$300 additional annual farming income

Technology and Approach

- **Functions:** supplier management, yield projections, purchasing & inventory management, quality assurance, logistics, performance monitoring
- **Software used**: **Commcare** for data collection platform, **Salesforce** for back-end database, **Telerivet** for payments, **Excel** for M&E and ops management
- Process: farmers purchase scratch cards with monetary value, myAgro vendor texts payment and farmer ID information via Telerivet to update Salesforce

Key Takeaways

- **It took "years of behavioral change (to build) trust in our system"**
- 5 year transition from paper to digital for data collection
- Scratch card purchased by farmer serves as receipt of goods, can be used to check myAgro's database
- Real-time data on Salesforce helps with farmer intervention
- CommCare & Salesforce are not seamlessly integrated

Implications for SFA

- **Digital integration takes time**
- Building **trust at the farmer level** is key
- **Do due diligence when selecting technologies**
  - Seamless integration between data collection and data aggregation functions can be a challenge
- Providing **receipts for farmers** builds trust and gives them ownership over their information and financials

Effective operational processes are essential

SMASH Mobil

Case Study (4 of 6)

Estimated cost: $$

Situation

- **Purpose:** custom mobile technology to support value chain intervention for Haitian smallholder farmers
- **Scope:** public-private partnership managed by Papyrus (Haitian firm) between USAID, Inter-American Development Bank, and Brasserie Nationale d'Haiti (part of Heineken beer conglomerate), tech developers: RTI International and dimagi
- **History[1]:** SMASH launched in 2013 with SMASH Mobil launched in 2016

Technology and Approach

- **Functions:** supplier management, yield projections, purchasing & inventory management, quality assurance, logistics, performance monitoring
- **Software used**: **Commcare** for field-facing data collection platform, **Tableau** for data visualization
- **Features**: works offline, longitudinal tracking, localized in Haitian Creole

Key Takeaways

- **Tech drove operational efficiency:** 90% reduction in time for extension agents to collect data from farmers
- **Phased Rollout:** working app ready in March 2017 and full system rollout by end of 2017
- **Challenging transition from paper:** required extensive training and time
- **Strong development team:** software (RTI, dimagi, Tableau) and project management (Papyrus)
- **Hired full-time data management specialist**

Implications for SFA

- **Expect challenges and delays when transitioning between technologies** (e.g. paper to digital)
- **Data validation processes** (whether automated or manual) must be a foundational element of any data management system
- Can be **costly and time-intensive to build from scratch**; instead, consider tweaks to an existing platform
- Appropriately sizing internal team is essential

Few organizations have succeeded at traceability down to the farmer level

Case Study (5 of 6)

Estimated cost: $$$

Situation

- **Purpose:** the Alliance for a Green Revolution in Africa (AGRA) is an organization that primarily works with smallholder farmers to increase the incomes and improve food security
- **Scope: e**leven countries across Africa
- **Impact: t**rained almost 40,000 agro-dealers, 80,000 lead farmers, and linked over 750,000 farmers to offtake markets

Technology and Approach

- **Functions:** purchasing & inventory management, quality assurance, logistics, performance monitoring
- **Software used:** local grantees collect data then input into AGRA's **custom online system**
- Agra works with grantees to **ensure data validity, but little standardization of data collection**
- Works with local grantees to scale impact – less contact with individual farmers

Key Takeaways

- AGRA **does not compile data down to individual farmers** → difficulties in collecting such detailed information
- AGRA's grantees mostly **collect data on pen and paper**
- AGRA mainly **tracks project-level outcomes**
- Currently exploring solutions for better data management, but **no unified system yet**

Implications for SFA

- Achieving traceability is hard
- Traceability down to the **individual farmers is very difficult**
- **Balancing between detailed data collection and scale**
- Through all of our research, **we did not find any single organization that had stellar data management**

Existing models for effective data management and traceability are available

Chetna Organic
Environment..Ethics..Equilibrium

Case Study (6 of 6)

Estimated cost: $

Situation

- **Purpose:** to make farming system more sustainable and more profitable in India
- **Scope:** 8,138 member farmers 9 Farmer Cooperatives from 290 villages in 3 states
- **Impact:**
  - Premium price for the specialized cotton production: 10-15% above market price
  - Procure seeds at a reasonable price due to scale

Technology and Approach

- **Functions:** farmer management, purchasing & inventory management, quality assurance, logistics, performance monitoring, traceability
- **Software used: SourceTrace**
- 100% farmer-owned supply chain of collective procurement and sale
- Establish a producer company to build direct relationships with brand, distributors

Key Takeaways

- **Direct and long term relationship** with distributors and buyers to eliminate middleman
- A **comparative advantage**-organic farming and fair trade- contributes to a **higher price premium**
- Rising demand for transparency and traceability

Implications for SFA

- There are already technological solutions that satisfy SFA's needs
- Gain comparative advantage – **standardized advanced farming techniques** (organics, fair trade, and etc) is key to charge premium price
- Collective procurement and sale for collective bargaining

Based on our survey, it will be difficult to achieve SFA's "Asks" all at once

Case Study Summary

"Asks"	ONE ACRE FUND	FAO	m	SMASH Mobil	AGRA	Chetna Organic
1 **Farmer Management**	✔	✔	✔	✔	✔	✔
2 **Traceability**	✖	✖	✖	✖	✖	✔
3 **System Cohesion**	✖	✖	✖	✔	✖	✔
4 **Innovation**	✖	✔	✔	✔	✖	✔
Cost-Efficient	$$	$$$	$$	$$	$$	$

SFA should emulate 6 key features

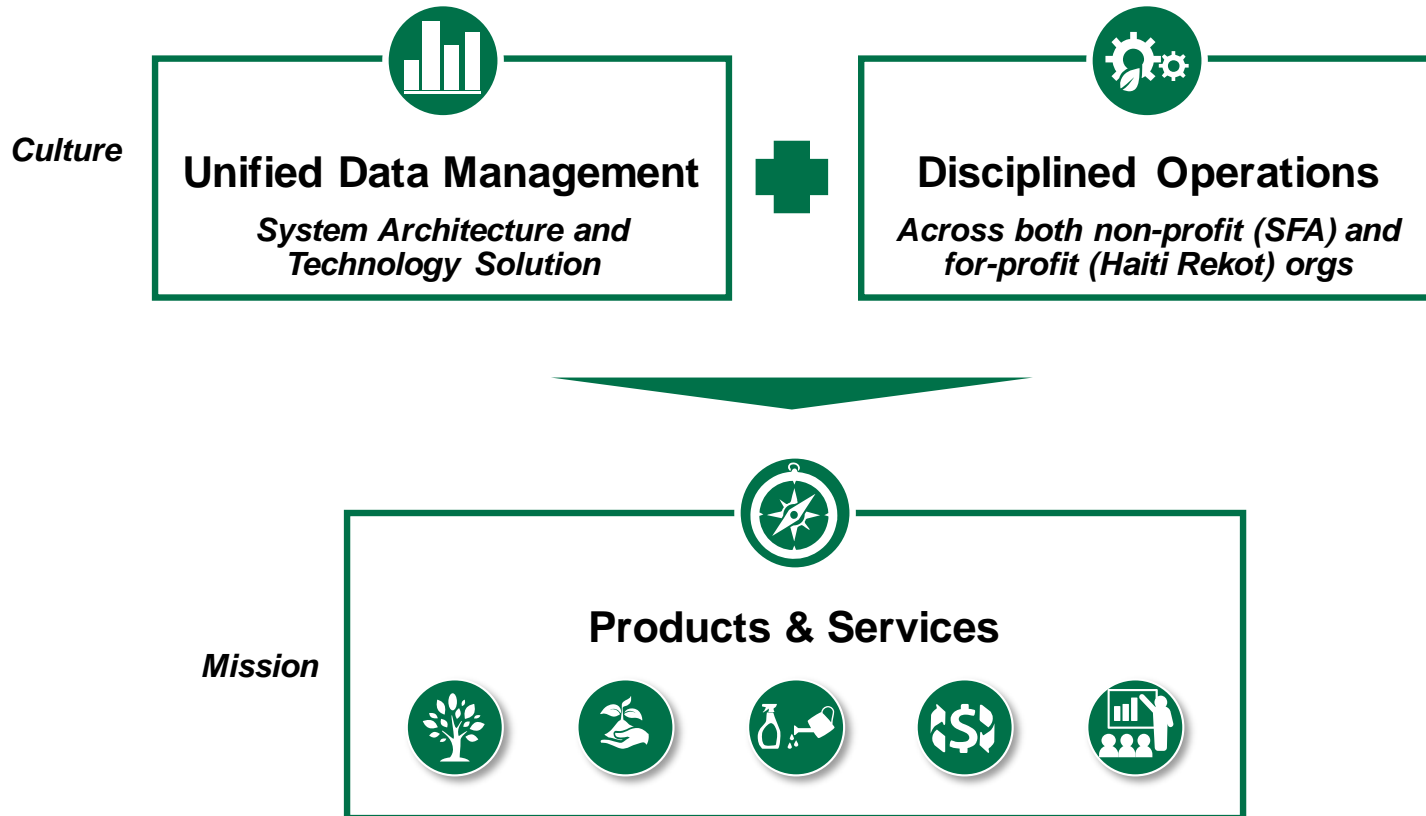**Best Practices in Data Management**

1 **Resource appropriately:** hire/train staff to foster data-driven culture

2 A sound **foundational database architecture** is essential

3 Proper implementation and digitization takes **TIME**

4 Consider a **phased rollout;** realistically expect challenges and delays

5 **Building trust** within farmer communities is key in tech deployment

6 **Start small then scale what works**

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- **Recommendations:** ***System Architecture, Technology Solution, Innovative Expansion***

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Fostering a disciplined, data-driven culture will be essential to SFA's transformation

SFA Value Set

Culture

Unified Data Management
System Architecture and Technology Solution

Disciplined Operations
Across both non-profit (SFA) and for-profit (Haiti Rekot) orgs

Mission

Products & Services

First, it is critical to lay enduring foundations for data capture and management

Recommendation (1 of 3)

System Architecture

Features:
- Established linkages among data stocks and flows
- Covers SFA's suite of services and impact metrics
- Should be ready to go from the start

Value:
- Foundation for operational excellence
- Unifying thread to help tell a comprehensive story
- Tech agnostic, i.e. tech as the lever, not the goal

As SFA evolves over time, so should its technology solution

Recommendation (2 of 3)

Technology Solutions

Features:
- Simple, usable, adaptable, durable
- Appropriate to data management maturity
- Functional first, innovative later

Value:
- Lever to deliver SFA's mission
- Fosters transparency and insight generation
- Provides infrastructure stability as SFA grows

System Architecture

Features:
- Established linkages among data stocks and flows
- Covers SFA's suite of services and impact metrics
- Should be ready to go from the start

Value:
- Foundation for operational excellence
- Unifying thread to help tell a comprehensive story
- Tech agnostic, i.e. tech as the lever, not the goal

Grow by being clear-minded about core capabilities that deliver SFA's strategic intent

Recommendation (3 of 3)

Innovative Expansion

Features:
- Cutting-edge innovations
- Build strong team (internally & externally)
- Data-driven, disciplined operations

Value:
- Tech as lever to deliver strategic intent
- Value-add capabilities and expertise
- Long-term profitability will drive growth

Technology Solutions

Features:
- Simple, usable, adaptable, durable
- Appropriate to data management maturity
- Functional first, innovative later

Value:
- Lever to deliver SFA's mission
- Fosters transparency and insight generation
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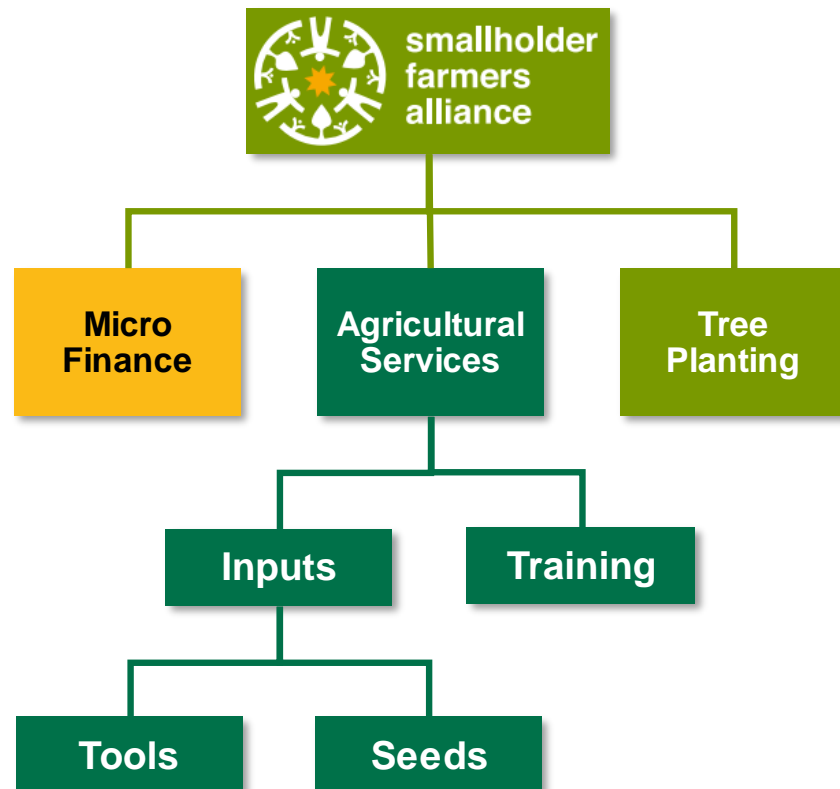
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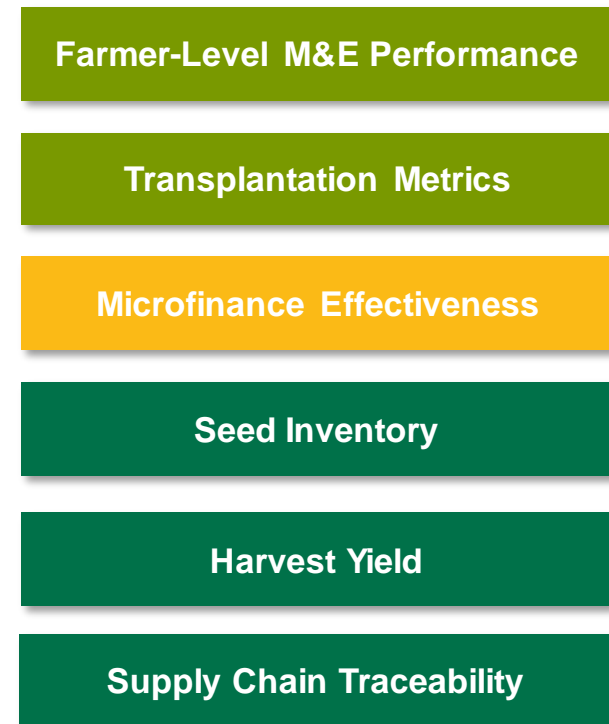
Recommendations: System Architecture

Using SFA's suite of services and desired impact metrics as a starting point…
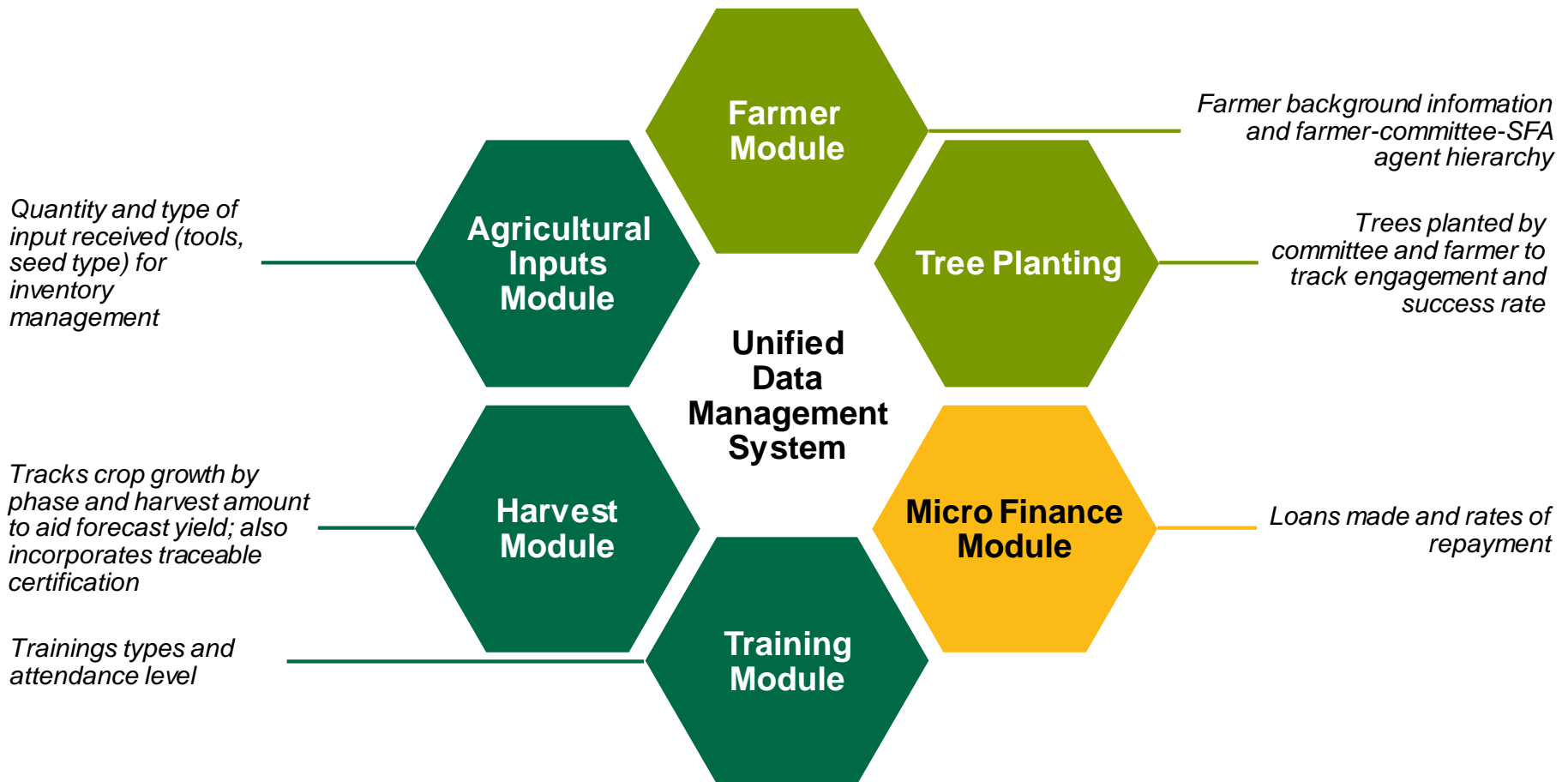
Scope

| **Suite of Services** | **Desired Impact Metrics** |

…will inform the overall blueprint of SFA's data system

Database Modules

Farmer background information and farmer-committee-SFA agent hierarchy

Quantity and type of input received (tools, seed type) for inventory management

Trees planted by committee and farmer to track engagement and success rate

Farmer Module

Agricultural Inputs Module

Tree Planting

Unified Data Management System

Tracks crop growth by phase and harvest amount to aid forecast yield; also incorporates traceable certification

Harvest Module

Micro Finance Module

Loans made and rates of repayment

Trainings types and attendance level

Training Module

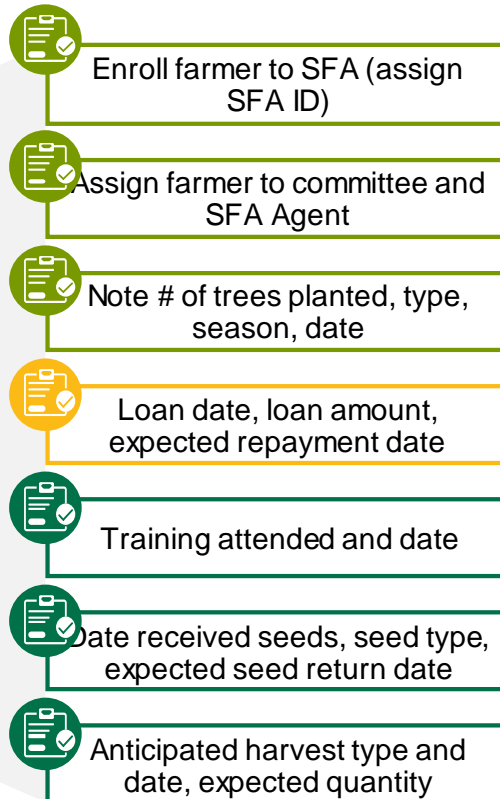Note: see Excel-based blueprint for details

An effective system seamlessly facilitates insight generation
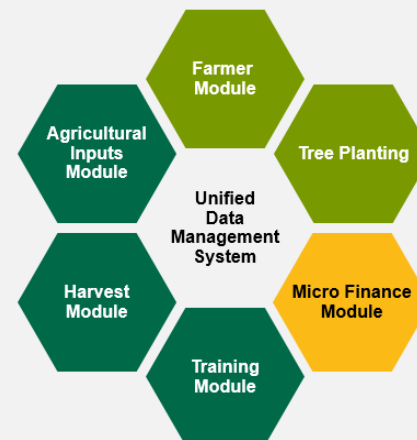
Data Management Process
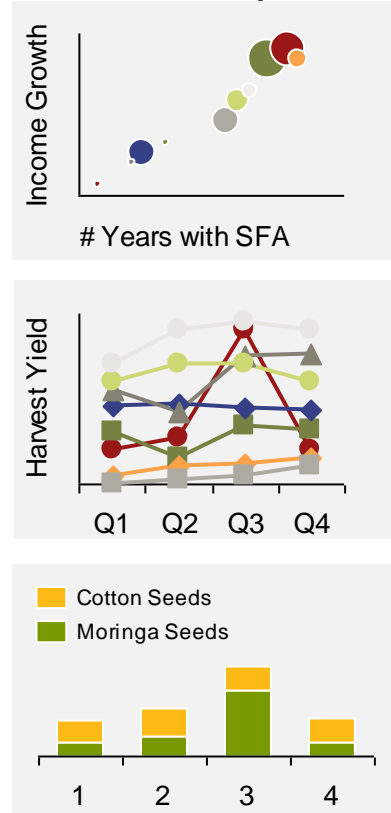
1 Farmer & SFA agent interaction

2 Agent inputs farmer data through surveys

3 Data aggregated, validated, and linked (SFA ID)

4 Dashboard reporting and analysis

Enroll farmer to SFA (assign SFA ID)

Assign farmer to committee and SFA Agent

Note # of trees planted, type, season, date

Loan date, loan amount, expected repayment date

Training attended and date

Date received seeds, seed type, expected seed return date

Anticipated harvest type and date, expected quantity

Unified Data Management System

- Farmer Module
- Tree Planting
- Agricultural Inputs Module
- Micro Finance Module
- Harvest Module
- Training Module

Income Growth

Years with SFA

Harvest Yield

Q1 Q2 Q3 Q4

Cotton Seeds
Moringa Seeds

1 2 3 4

Note: see Excel-based blueprint for details

Ideally, farmers will have a platform or tool to help them track and manage their data

SFA Passport

Illustrative

What It Is

- Record or receipt for farmers to show:
  - Inputs received
  - Trainings attended
  - Microfinance loans received
  - Trees planted
  - Is **unique to the farmer**

Why It Matters

- **Ownership and empowerment** for farmers
- **Transparency and accountability**
- Serves as **a check** against SFA records

How it Works

- Receives 15 seeds units
- Attends 20 trainings

# seeds	# trainings:
★★★★★	★★★★★
★★★★★	★★★★★
★★★★★	★★★★★
	★★★★★

Consider ease of use for farmers, i.e. passport may simply be a physical document (i.e. paper) in the beginning

Some key considerations will improve the likelihood of successfully deploying a unified data management system
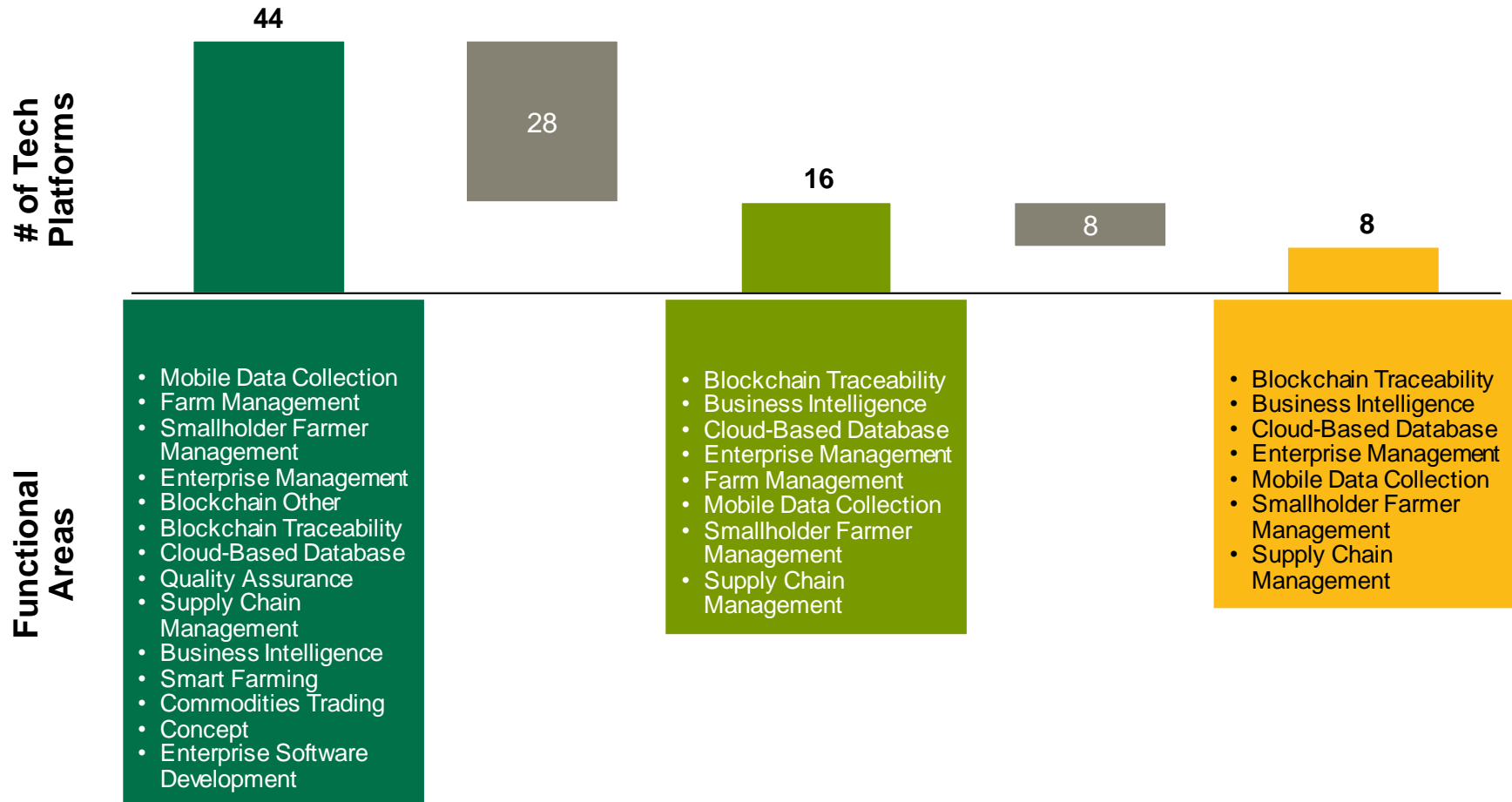
System Architecture Success Factors

1. System, especially data collection, should be **ready to go from the start**

2. **Allocate ample time** for initial build-out; **implement and revise in phases**

3. **Cultivate data-driven culture & processes** internally and among farmers

4. **Extensive training for farmers** will be necessary

5. **Adapt data management processes as needed** to maximize adoption

Recommendations: Technology Solutions

We whittled down 15 functional areas and 44 platforms initially identified…

Evaluation Process (1 of 2)

# of Tech Platforms

44 | **28** | **16** | **8** | **8**

Functional Areas

44:
- Mobile Data Collection
- Farm Management
- Smallholder Farmer Management
- Enterprise Management
- Blockchain Other
- Blockchain Traceability
- Cloud-Based Database
- Quality Assurance
- Supply Chain Management
- Business Intelligence
- Smart Farming
- Commodities Trading
- Concept
- Enterprise Software Development

16:
- Blockchain Traceability
- Business Intelligence
- Cloud-Based Database
- Enterprise Management
- Farm Management
- Mobile Data Collection
- Smallholder Farmer Management
- Supply Chain Management

8:
- Blockchain Traceability
- Business Intelligence
- Cloud-Based Database
- Enterprise Management
- Mobile Data Collection
- Smallholder Farmer Management
- Supply Chain Management

Note: see interview notes for further details

…according to these 6 criteria

Evaluation Process (2 of 2)

Functionality

- Farmer digital identity
- Output traceability
- Business management
- Microcredit and payments

Ease of Use

- For agent data entry
- Administrative use of dashboards

Customizable

- Adaptability to SFA business model
- Survey design
- Language (Creole / French)

Cost-Effective

- Purchase and subscription fees
- Application development costs

Data Validation

- RFID / Barcode integration
- GPS tag
- User-specific permission

Offline Capability

- Mobile data entry
- Synchronization requirements

Ideal solution should be appropriate to SFA's development phase relative to data capture and management

Development Phases & Functional Criteria

Nascent

Features:
- Minimal data collected
- If collected, disaggregated
- Difficult or time-consuming to update

Priorities
- Build data culture
- Need for rapid uptake
- Certification processes & farmer registry

Emerging

Features:
- Intermediate stage of data management
- Processes and systems in place

Priorities:
- Automate data entry
- Established data validation processes
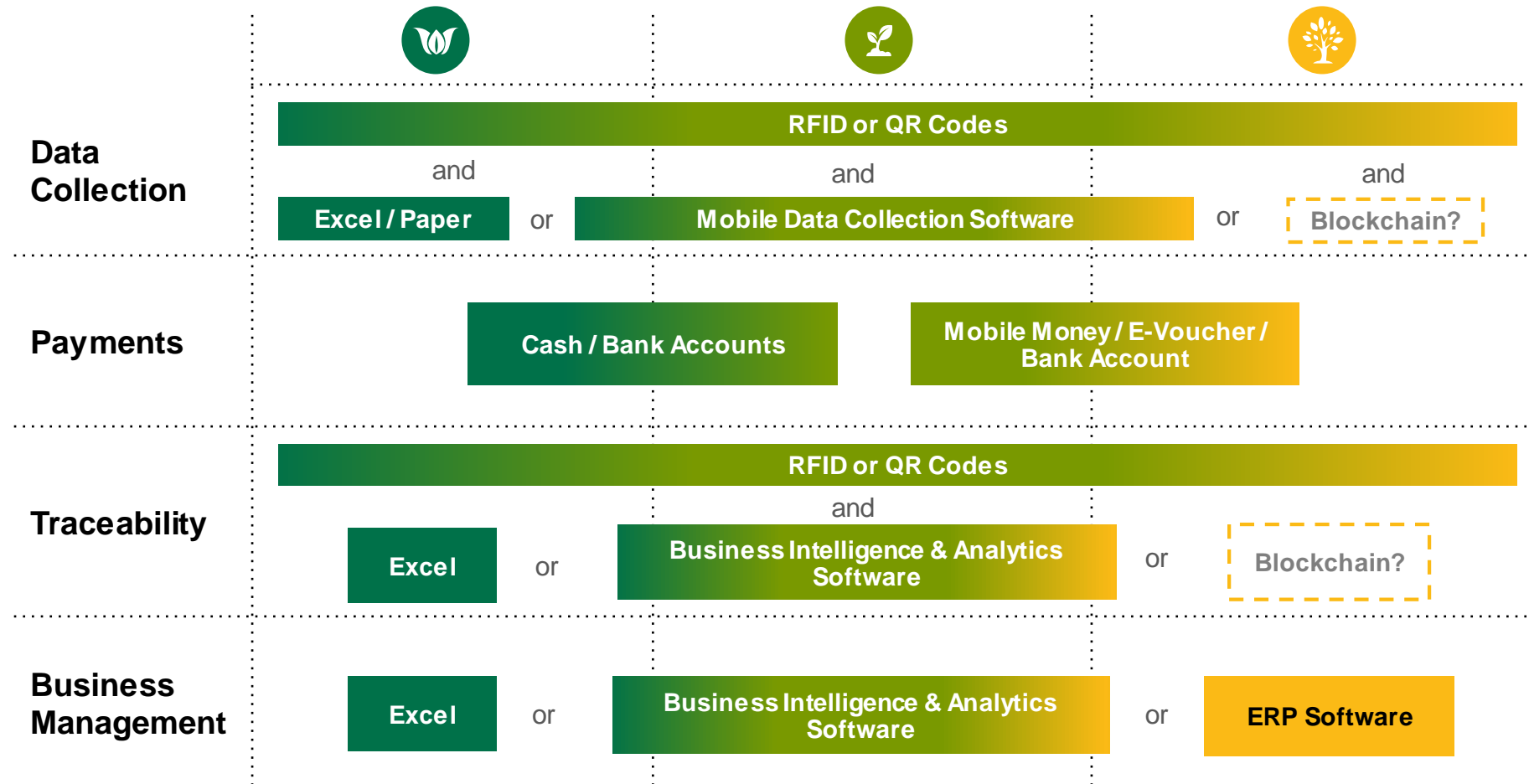- Increase focus on analysis

Mature

Features:
- Advanced data management processes and systems
- Seamless from data collect to analysis

Priorities:
- Increasing enterprise needs & capacity
- Apply innovative traceability platform (e.g. blockchain?)

Because no single platform currently meets SFA's needs, we recommend adopting the following technologies by phase

Technology Recommendations

Data Collection	**RFID or QR Codes**		
	and	and	and
	Excel / Paper or	**Mobile Data Collection Software** or	**Blockchain?**
Payments	**Cash / Bank Accounts**	**Mobile Money / E-Voucher / Bank Account**	
Traceability	**RFID or QR Codes**		
		and	
	Excel or	**Business Intelligence & Analytics Software** or	**Blockchain?**
Business Management	**Excel** or	**Business Intelligence & Analytics Software** or	**ERP Software**

We applied the evaluation criteria and considered SFA's needs to develop this shortlist

Short-Listed Platforms

	BanQu	IBM	farmforce	SAP	agrocentral	agrivi	taro WORKS	smallholdr	CommCare	SourceTrace	ChainPoint	(O)	kintone	SAP S/4HANA	tableau	qb
Functionality	Yellow	Green	Yellow	Green	Yellow	Yellow	Green	Green	Green	Green	Green	Yellow	Green	Yellow	Yellow	Green
Ease of Use	Yellow	Yellow	Green	Red	Green	Yellow	Red	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Customizable	Green	Green	Yellow	Red	Red	Red	Yellow	Yellow	Green	Green	Green	Green	Green	Green	Green	Yellow
Cost-Effective	Red	Red	Green	Yellow	Green	Yellow	Green	Yellow	Green	Green	Red	Yellow	Yellow	Red	Green	Yellow
Data Validation	Green	Green	Yellow	Yellow	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Offline	Green	Red	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Yellow	Yellow	Green	Green
Overall	Yellow	Yellow	Yellow	Red	Red	Red	Yellow	Yellow	Green	Green	Green	Red	Yellow	Yellow	Yellow	Yellow

Note: see interview notes for further details

…and specifically recommend the following platforms…

Recommended Platforms

Recommended Platforms by Maturity Phase

	SourceTrace	CommCare	tableau	quickbooks	kintone	ChainPoint	BanQu	IBM
Data Collection	○	○				○	○	○
Payments				○		○	○	○
Traceability	○	○				○	○	○
Business Management	○		○	○	○			

or   **or**   **or**

and   **or**

Nascent   **Emerging**   **Mature**

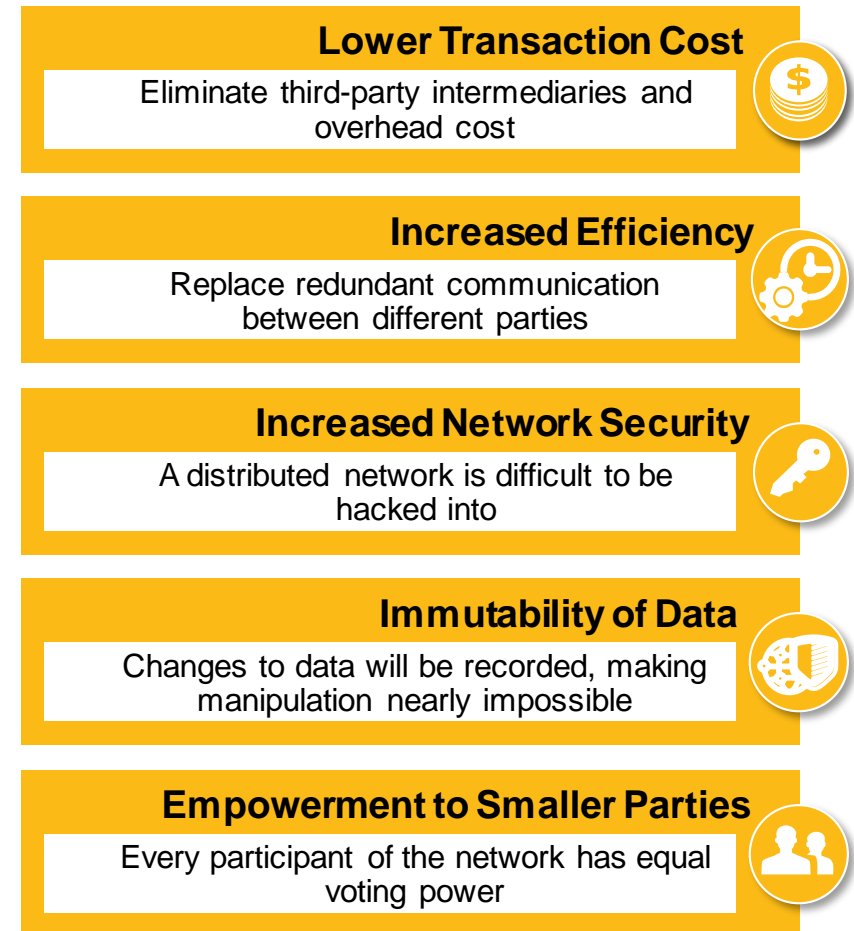Source: Columbia capstone team analysis

50

Recommendations: Innovative Expansion (Blockchain)

Blockchain is an innovative technology for processing, managing, and recording transaction histories

Features

Distributed Ledger

A single digital ledger that is shared across the network

Decentralized system

No single point of central control

Ownership Rights

Every participant of the network has a copy of all the transactions

Encryption

Every transaction is encrypted and stored in a hash value

Node Governance

Every node in the network in equally important to the system

Value

Lower Transaction Cost

Eliminate third-party intermediaries and overhead cost

Increased Efficiency

Replace redundant communication between different parties

Increased Network Security

A distributed network is difficult to be hacked into

Immutability of Data

Changes to data will be recorded, making manipulation nearly impossible

Empowerment to Smaller Parties
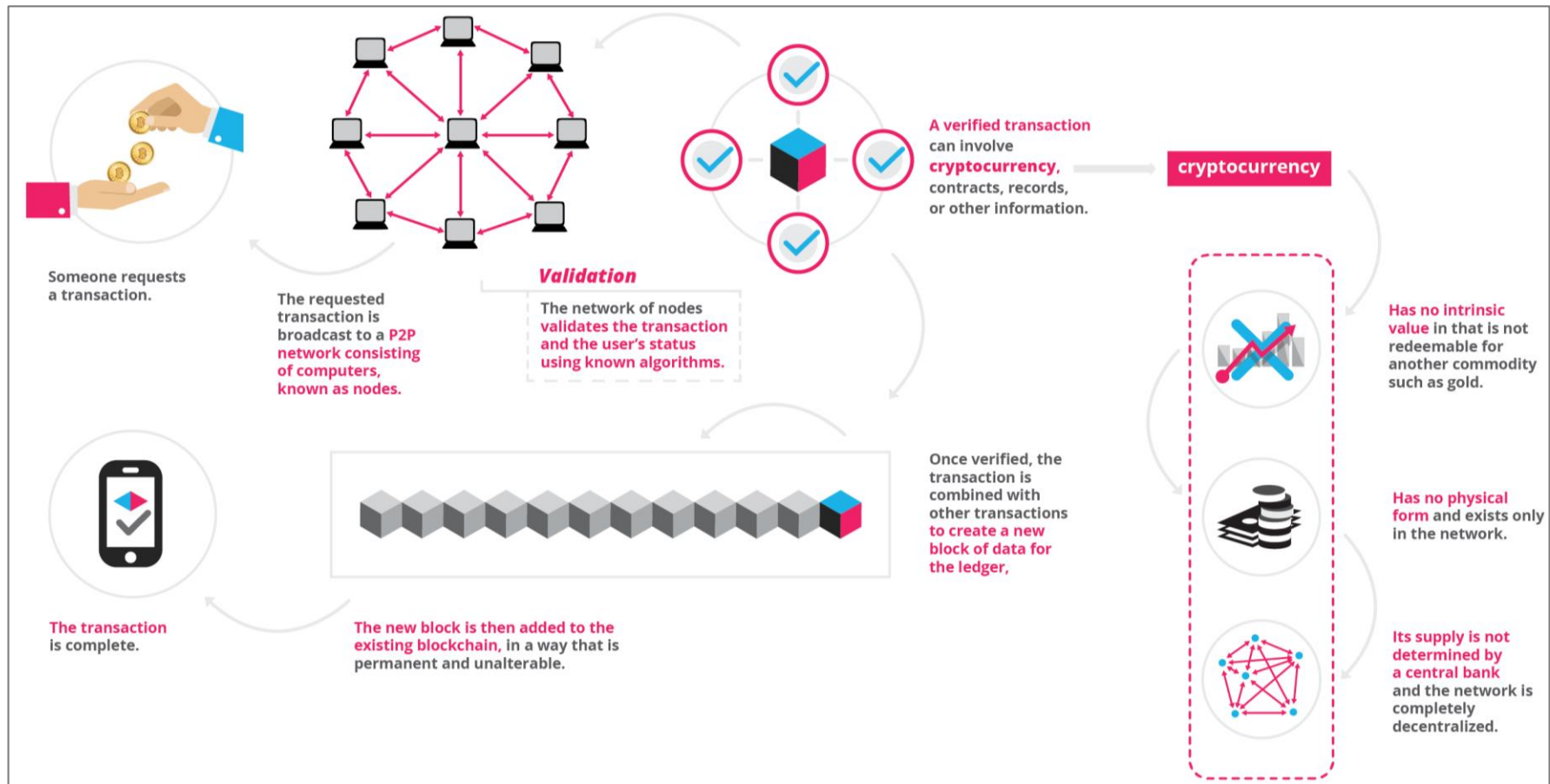
Every participant of the network has equal voting power

Each verified transaction or block is added to other blocks, creating an immutable chain of information

How Blockchain Works

Someone requests a transaction.

The requested transaction is broadcast to a P2P network consisting of computers, known as nodes.

Validation

The network of nodes validates the transaction and the user's status using known algorithms.

A verified transaction can involve **cryptocurrency**, contracts, records, or other information.

cryptocurrency

Once verified, the transaction is combined with other transactions to create a new block of data for the ledger,

The new block is then added to the existing blockchain, in a way that is permanent and unalterable.

The transaction is complete.

Has no intrinsic value in that is not redeemable for another commodity such as gold.

Has no physical form and exists only in the network.

Its supply is not determined by a central bank and the network is completely decentralized.
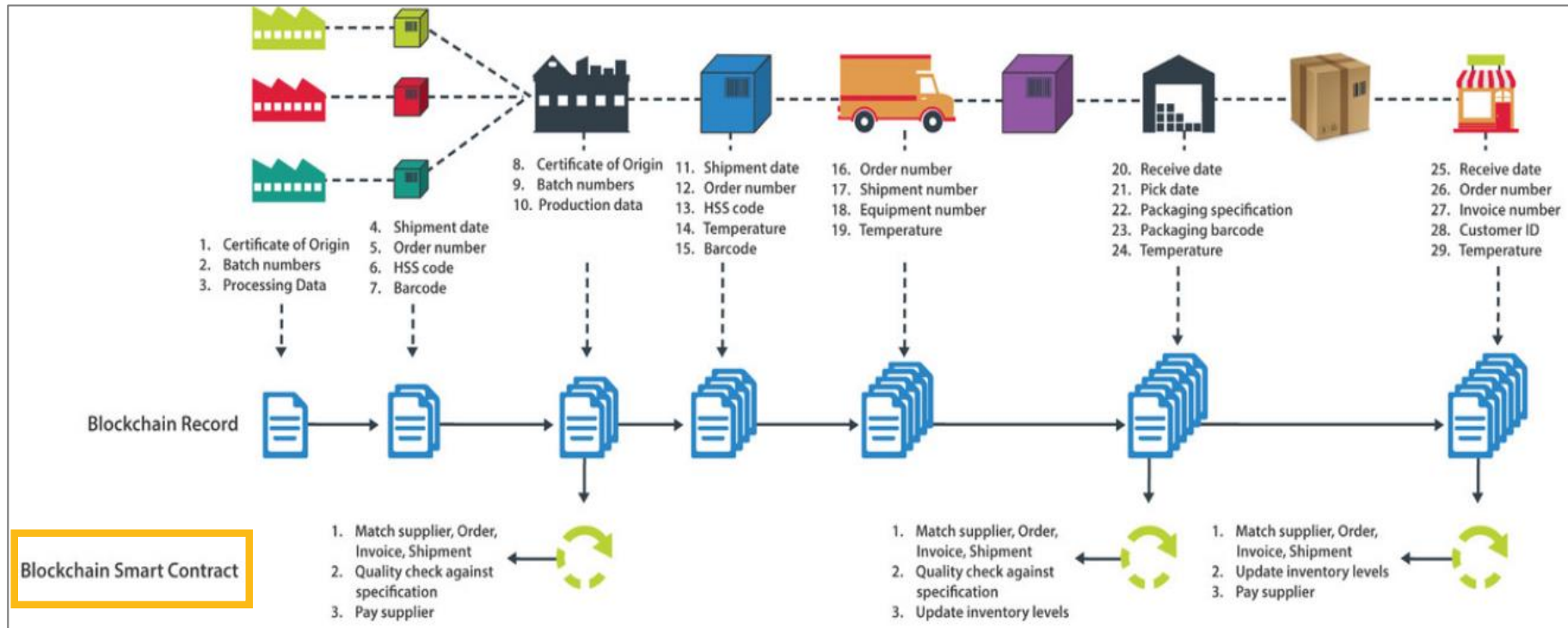
Existing and emerging blockchain applications rely heavily on advanced data management systems

Blockchain Applications
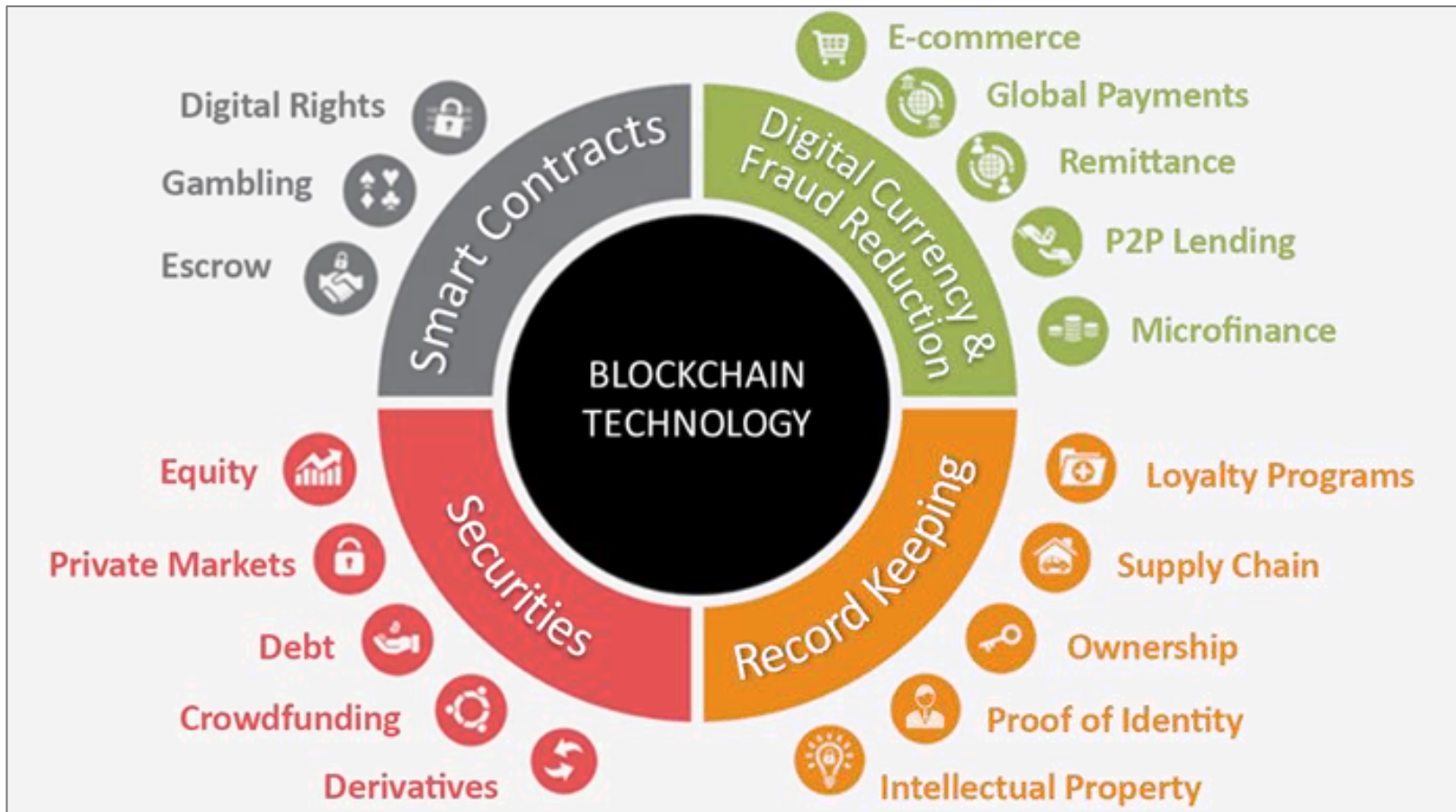
While SCM applications are fairly new[1], smart contracts may improve traceability and security and lower compliance costs

Blockchain for Supply Chains

We have identified a few supply chain cases for deploying blockchain

Development to launch can take years – even for organizations with advanced data systems

Case Study: Diamond Traceability

Situation

- **Purpose:** diamond traceability initiative to demonstrate "authenticity, transparency, and provenance"
  - Conflict-free assurance (i.e. not "blood" diamonds)
- **Scope:** end-to-end diamond value chain (from mine to store) with full industry engagement
- **Impact:** "Single, tamper-proof digital diamond ledger," aims to foster inclusion, trust, efficiency, security

Implications for SFA

- Blockchain solution **spans the entire value chain**
- **Development takes time**, even for an established organization
- **Industry buy-in and engagement at all stages of development** (from ideation to launch) is necessary

Approach

- Diamond Time-Lapse underwent a **three-year development phase** before launch in 2017
- Certification implicit in transactions via smart contract

Source: Diamond Time-Lapse Project (Everledger), DeBeers Blockchain Initiative (press release), Diamond Blockchain Initiative

A mature supply chain and data management system with full stakeholder buy-in is necessary

Case Study: Cost Efficiency and Traceability in Mangoes

Situation

- **Purpose:** improved **food safety and remediation**
- **Scope:** 16 farms, two packing houses, three brokers, two import warehouses, and one processing facility
- **Impact:**
  - **Operational efficiency and cost savings**: quickly identify the precise point of contamination in seconds instead of weeks
  - **Improved visibility and accountability**: ensure provenance of mango supply

Approach

- **Unique identifier:** RFID tag for identifying each product
- **Smart contract:** automated if-then permissions logic that determines whether transactions may proceed
- **Hyperledger**: a large shared ledger to store all the information
  - Hyperledger is unique to IBM
  - Other blockchain providers use Ethereum

Key Takeaways

- Blockchain can be applied in **mature supply chain** system with clear process
- The success of blockchain as a food traceability solution requires **full and honest participation** from everyone within the system
- Implementation cost will depend on the scale of deployment (i.e. supply chain scope and complexity) and time (Walmart deployed solution in less than a year, but at a cost)

Implications for SFA

- SFA has to build mature supply chain with honest participation before deploying blockchain
- Developing the data management system with blockchain requires tradeoff between time and capital investment
- SFA can still, however, get **blockchain ready** in the meantime

Blockchain can complement legacy systems, but integration takes time

Case Study: Fair Value for Cocoa

Situation

- **Purpose:** To distribute **fair value** to farmers effectively
- **Scope:** Currently at **pilot stage** serving 1,000 farmers; aim to scale up to 10,000 farmers this year
- **Impact:**
  - Farmers get **more premium** from their products
  - Protection from cocoa price fluctuation
  - Improve **visibility and accountability** of payments

Approach

- Ban Qu blockchain solution works as an **add-on tool** to current M&E tool (Cocoatrace)
- Market price info is sent to farmer's phone and **farmer texts back** YES or NO to confirm the transaction
- "Smart Pick-up": agents make entries of produce weight and payment to farmers by **tablets**
- Farmer **payments made in cash** due to limited mobile banking penetration

Key Takeaways

- Blockchain needs to **work with other software** to deliver desirable results
  - Mars is still working through integration of legacy M&E tool and blockchain solution
- **Absence of infrastructure** (e.g. mobile payment) limits blockchain value proposition
- Hiring qualified personnel is ongoing but has delayed platform roll-out

Implications for SFA

- SFA has to **hire dedicated personnel** to manage data system
- **Be patient:** allot significant time (even years) to deploy
- Focus on understanding technology and **watch for industry advancements**
  - Do due diligence; risky to jump into unvetted tech
- SFA needs to **deliver value to farmers** in order to keep farmers motivated

Traceability can be achieved with existing non-blockchain software platforms

Case Study: Chain Point & Better Cotton Initiative

Situation

- **Purpose:** To provide **transparency and traceability**
- on the level of granularity required by end-users
- **Scope:** 12% of all cotton produced worldwide
- Better Cotton produced by 1.5Mn BCI farmers
- **Impact:** Consumers can retrieve product information by scanning a bar-code with a mobile phone
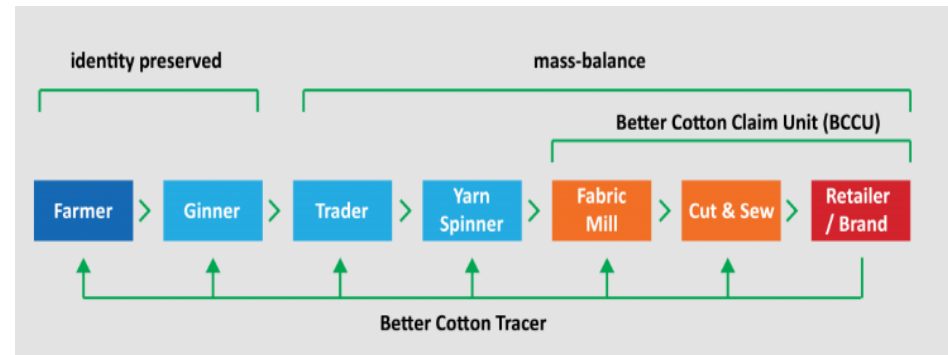
Approach

- **Better Cotton Tracer (BCT)** is a combination of **mass-balance administration** and the tracing of **"Better Cotton Claim Units"** (BCCUs). In mass-balance system, the volumes of sustainable product is tracked. At the yarn spinner, **each kilo** of Better Cotton is then **swapped into a BCCU**. A retailer can trace the BCCUs back to the yarn spinner that issued them
- **BCT** is classified as **private federal ledgers** (PFL)

Key Takeaways

- Private federal ledgers, **centrally governed,** enables more swift decision making than blockchain, which requires consensus
- A **combination of mass-balance and BCCUs** for tracking cotton

Implications for SFA

- PFL is more suitable for SFA than blockchain as it requires lower level of collaboration and commitment
- Use a combination of raw material and BCCUs to **dual-track**

identity preserved — mass-balance

Better Cotton Claim Unit (BCCU)

Farmer > Ginner > Trader > Yarn Spinner > Fabric Mill > Cut & Sew > Retailer / Brand

Better Cotton Tracer

Several key elements are necessary to deploy blockchain successfully

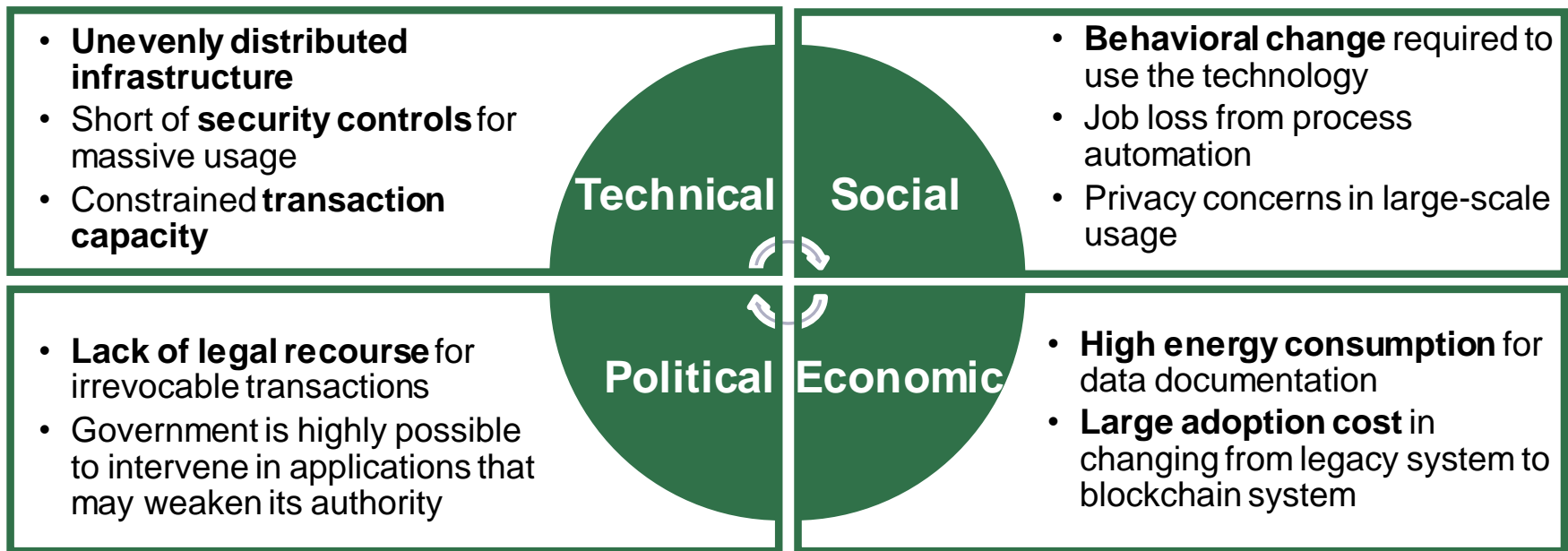## Blockchain Success Factors

Internal
• Availability of data
• Electronic and/or automated
• Established data management and validation processes
• Extensive mapping of nodes and data elements
• User access and management: having unique user IDs
• Authorized users and permissions

External
• Compelling value proposition for affected stakeholders
• Buy-in from all stakeholders
• Visibility into and ownership guidelines over transaction costs and ongoing cost accountability
• Integration with legacy systems and processes
• Privacy and security protocols

Given the relative infancy of blockchain, there are a number of challenges to its deployment

Challenges

Technical
- **Unevenly distributed infrastructure**
- Short of **security controls** for massive usage
- Constrained **transaction capacity**

Social
- **Behavioral change** required to use the technology
- Job loss from process automation
- Privacy concerns in large-scale usage

Political
- **Lack of legal recourse** for irrevocable transactions
- Government is highly possible to intervene in applications that may weaken its authority

Economic
- **High energy consumption** for data documentation
- **Large adoption cost** in changing from legacy system to blockchain system

"If blockchain is as big and universal as the Net, we are likely to do a comparably bad job of predicting both its upsides and downsides[1]"

There are three potential applications for blockchain in the SFA/Timberland context

Product Value Chain

SFA/Haiti Rekot   **Timberland**

| Cotton Production | Ginning | Fabric Production | Product Manufacturing | Retail | Consumer Use | End of Life |

1 *Farmer Management*

2 *Organic Certification*

3 *End-to-End Value Chain*

Full transparency and traceability potential is realized only when blockchain is deployed across the entire value chain

Blockchain, currently, is not a stand-alone, silver bullet that can help SFA deliver its mission

Blockchain Recommendations

1 Blockchain is still in a stage of relative infancy;
SFA should **wait for maturation of** technology and its applications

2 In the near term, blockchain will need to be **integrated with other technologies** and will **require organizational change**

3 Use technology to your advantage: **deploy the most cost-effective technology that achieves SFA's goals**

4 Industry-level or **full value chain implementation** maximizes blockchain's value proposition

5 Building a foundational data management system first will help SFA become **blockchain ready**

Agenda

■ Setting the Stage: *Overview of SFA*

■ Cotton in Context: *Certification Landscape & Requirements*

■ Best Practices in Data Management: *Agribusiness Case Studies*

■ Recommendations: *System Architecture, Technology Solution, Innovative Expansion*

■ **Executive Summary**

In closing…

■ SFA has tremendous runway to achieve its goals, but it will require solid operational discipline anchored by a **unified data management system**

- Establish foundations of a solid **system architecture**

- Over this, layer the appropriate **technology solution** to achieve SFA's mission

- As SFA's data management matures, consider ways to **innovatively expand**

  – Blockchain technology *currently* is not a viable stand-alone solution to deliver SFA's mission

  – SFA should wait for the technology to mature while fostering buy-in and collaboration across the value chain

  – In the meantime, SFA can still become **blockchain ready** by first building strong foundations for effective data management