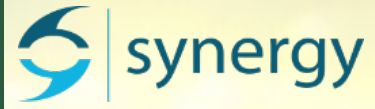


2021 FOOD SYSTEMS SUMMIT

Digital Marketplace Playbook

23 SEPTEMBER 2021



Introduction

Our Digital Marketplace Playbook presents a framework for leveraging digital and data innovation with supporting cases from emerging markets

A digitally enabled, data driven, sustainable food system can



Guarantee food security, food safety and inclusion



Provide high potential for economic growth and value creation



Engage and support small holder farmers



Recognize and apply consumer protection and engagement principles



Connect farmers with consumers in innovative and ethical ways

The digital marketplace playbook aims to



Map key leverage points for data and digital innovation in the food system



Highlight the digital and data solutions driving innovation across the food system



Share recommendations for governments around the world on how best to enable inclusive innovation across the food system

The following presentation will explore transparent, inclusive, sustainable scale models that enable all actors, from small scale producers to consumers, to build more efficient, climate-smart markets for healthy and nutritious food

Our current food systems are not sustainable



Sustainable food systems should focus on ensuring affordable and healthy food to all people while respecting planetary and social boundaries

We need local and global partnerships to ensure safe, inclusive, green, eco-socially progressive food production and consumption

Transforming the approach to food systems

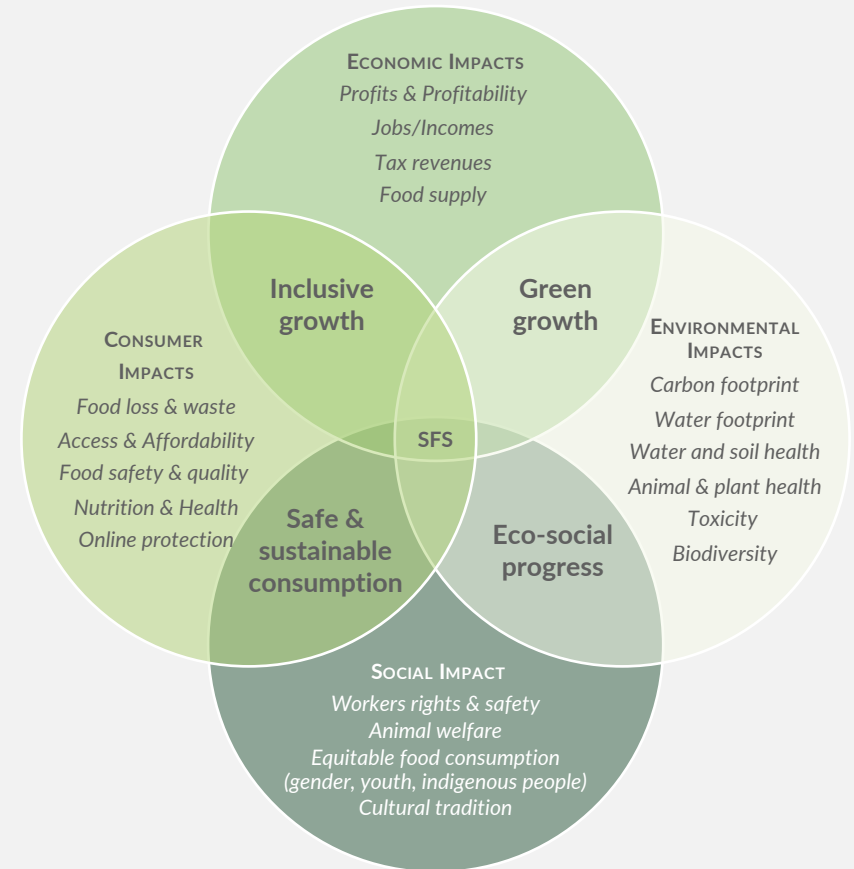
- In some regions of the world, particularly Sub-Saharan Africa, inadequate food production is still the major cause of food and nutrition insecurity
- This focus on food production leads to the neglect of other areas for the root causes of the food system's underperformance



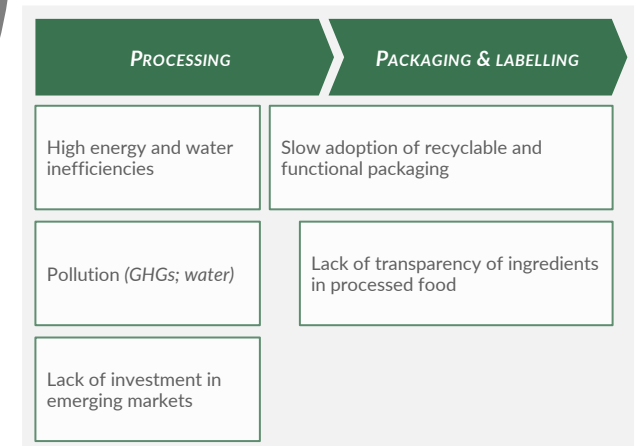
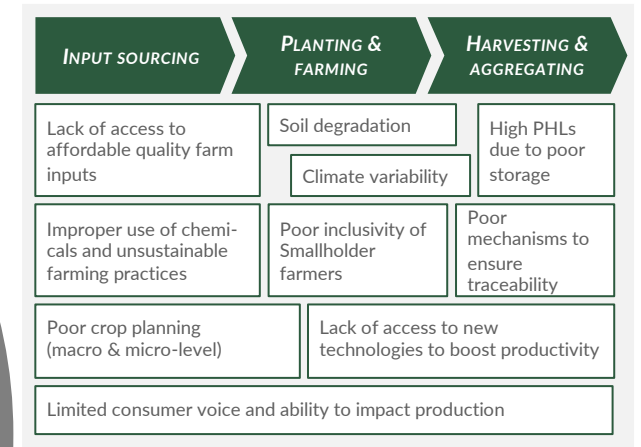
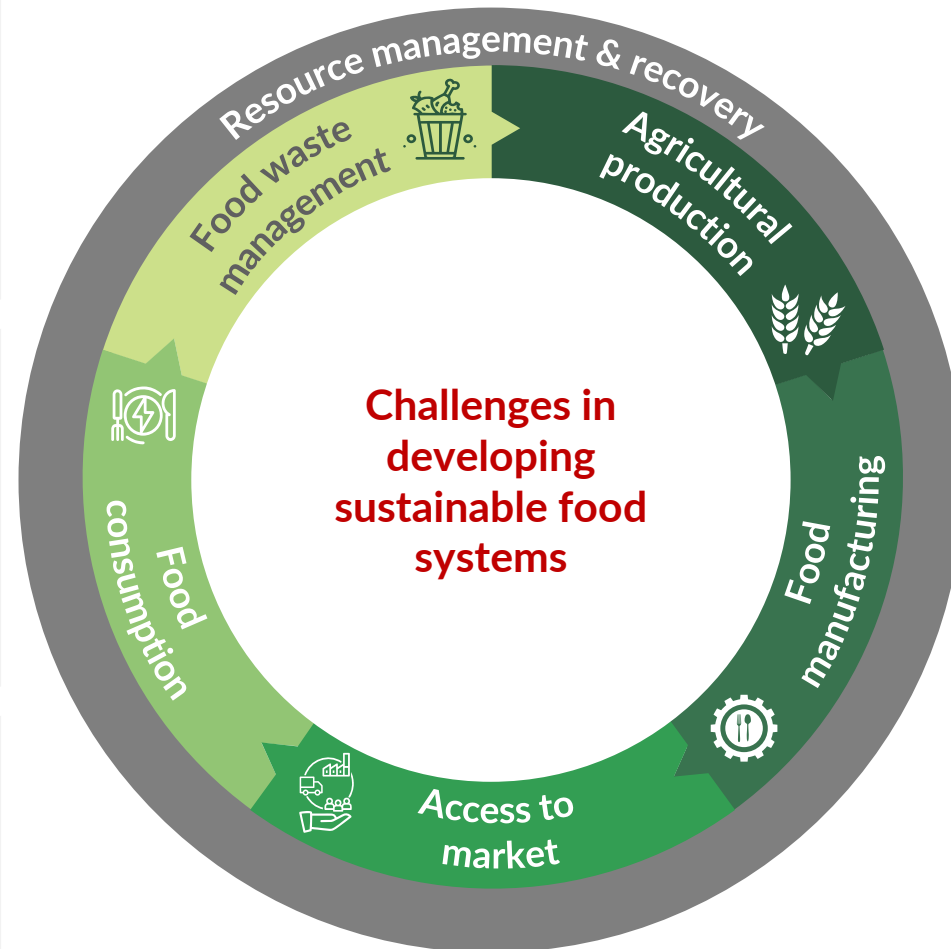
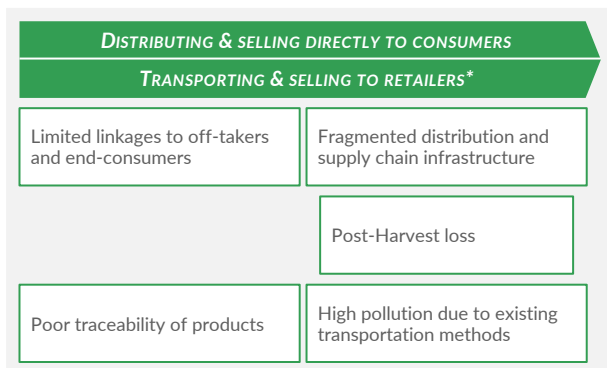
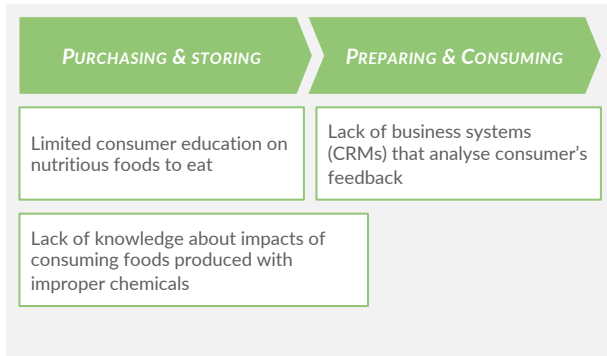
- Food systems now encompass the entire range of actors and their **interlinked value-adding activities** involved in the **production, aggregation, processing, distribution, consumption** and **disposal** of food products
- This **requires integrated actions taken by all stakeholders** at local, national, regional, and global levels and by both public and private actors
- Data across food systems acts as a key enabler for many actors involved in the production and consumption of food



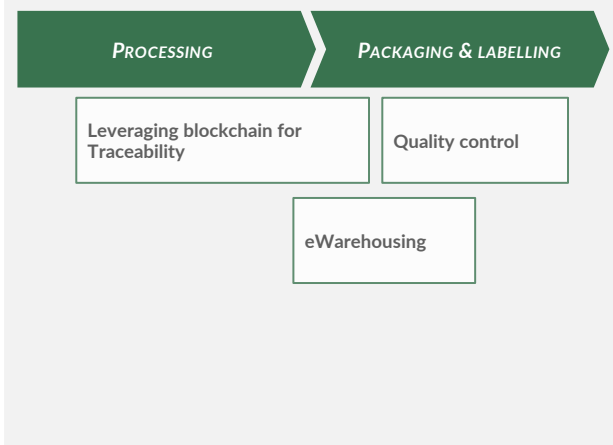
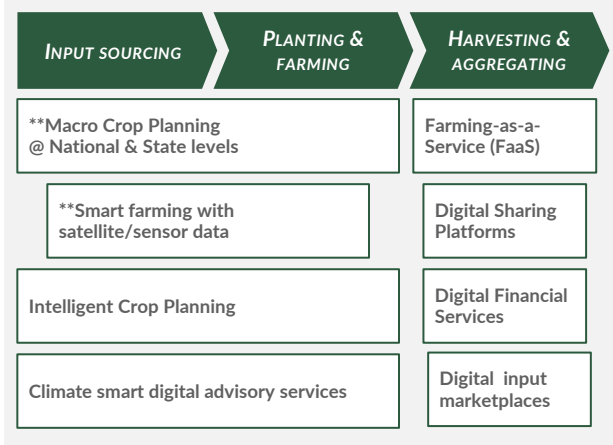
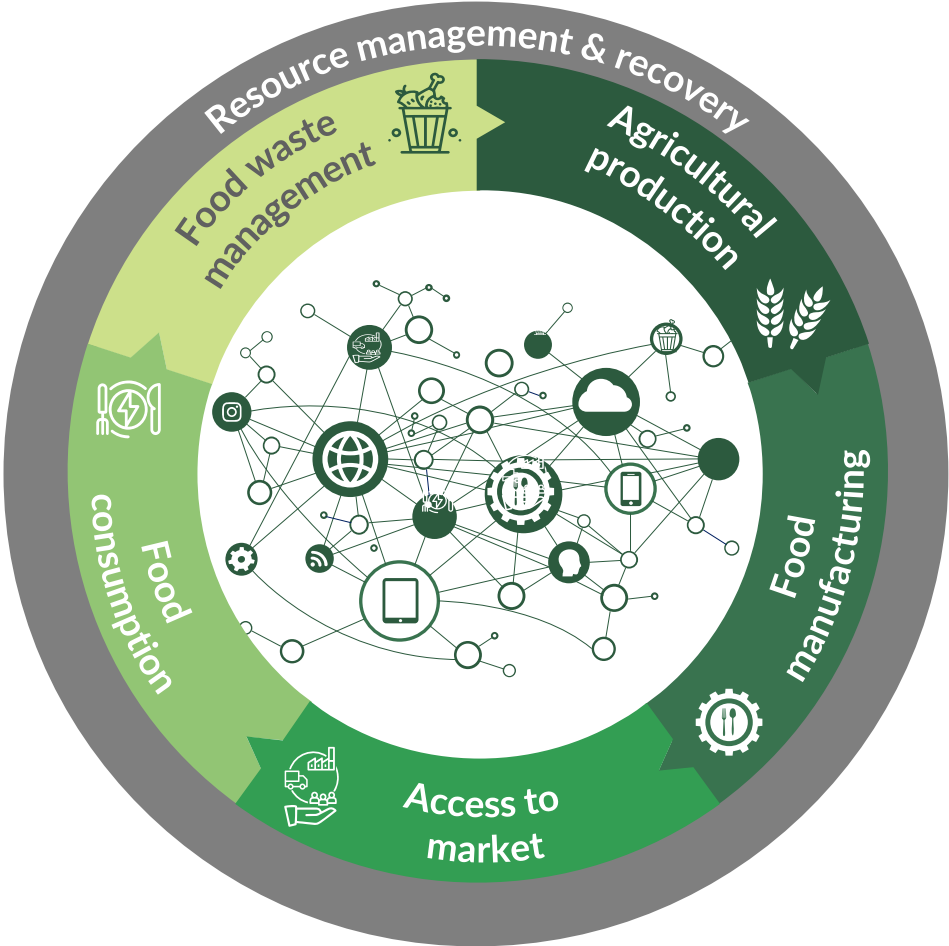
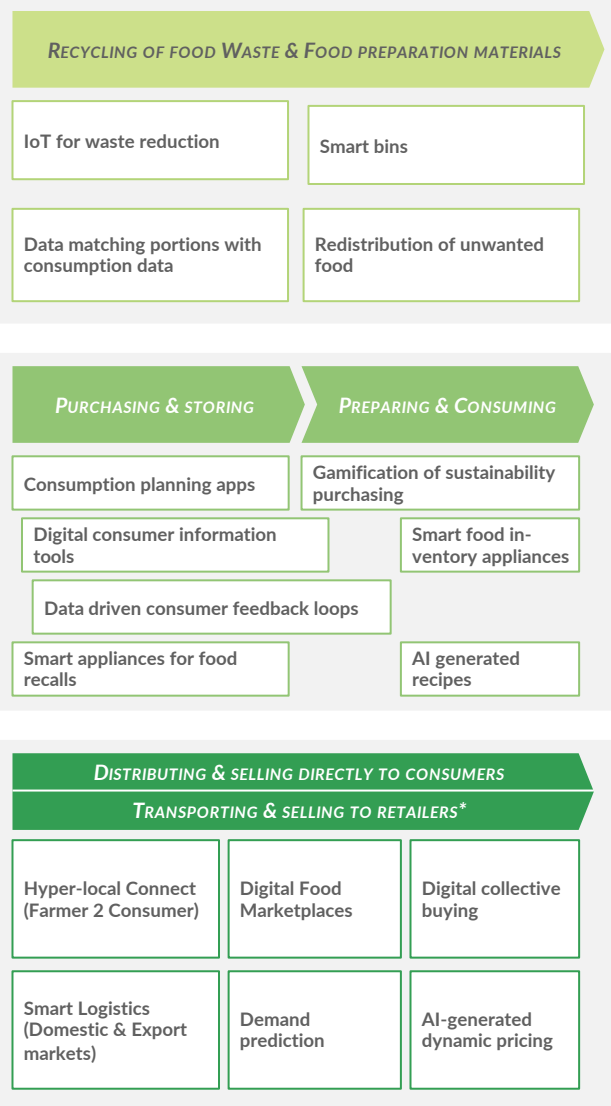
Defining a sustainable food system



Food systems face a wide range of challenges and complex interactions that impact food security and nutrition

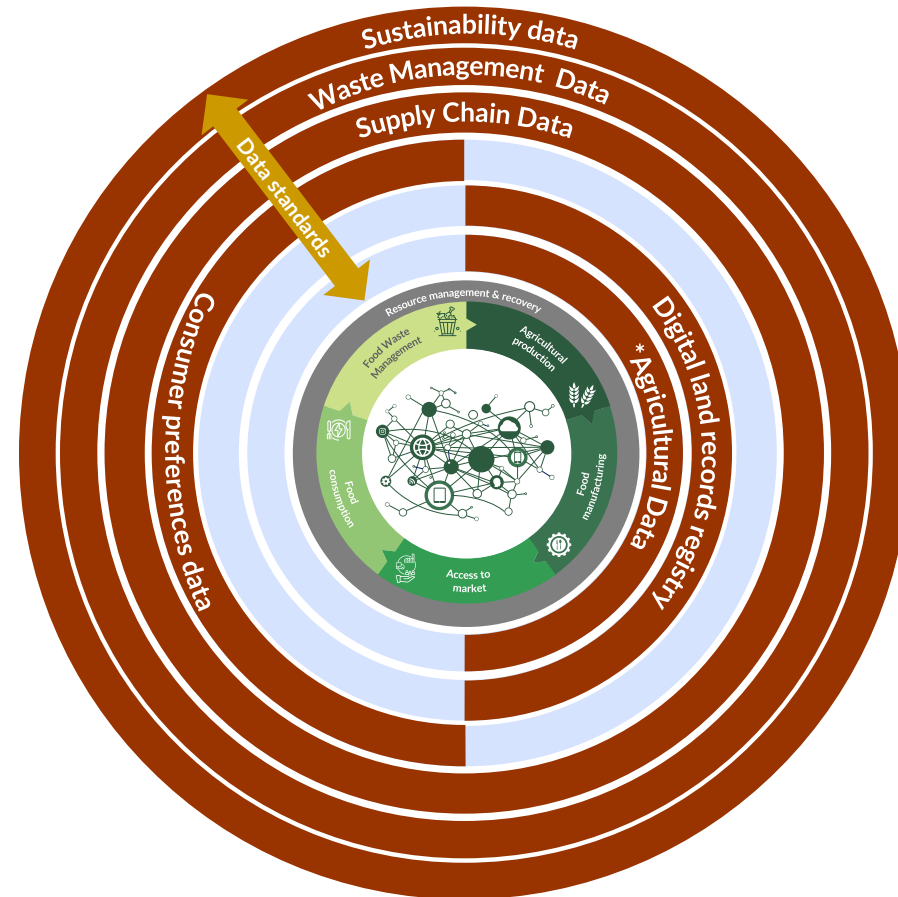


Digital solutions are becoming critical enablers of the sustainable food system but major gaps remain



Note: The asterix marks areas where there is government involvement

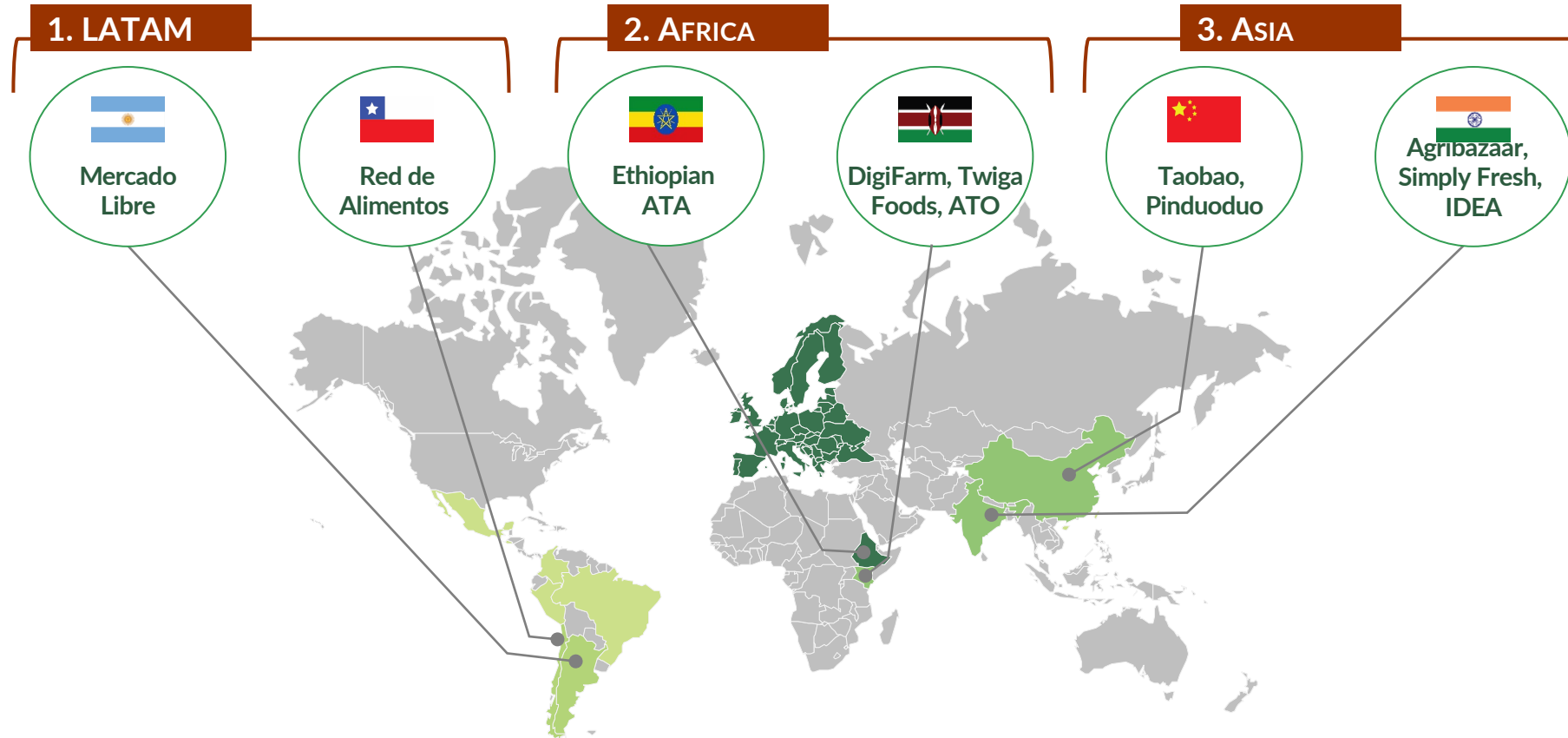
The large volumes of data being collected are helping to drive transparency, efficiency and inclusivity in food systems



Data standards are critical for all types of data collected to ensure transparency and efficiency in data sharing across the food system.

<p>Agricultural Data</p>	<ul style="list-style-type: none"> Data is collected on platforms that can aggregate multiple agricultural datasets. This also includes digital registries that can establish legal rights and basis for collateral, driving investment, food security and inclusivity Insights from datasets such as soil health records, crop yields, weather, and remote sensing can inform better farming practices in the agricultural sector These data sets and registries can enable emerging technology innovations and policy decision making, and create proof of ownership to access credit and facilitate value chain activities that increase productivity and revenue
<p>Sustainability Data</p>	<ul style="list-style-type: none"> Data is collected on the carbon, energy and waste footprint of agricultural production and across the supply chain. Rich data sets can help producers measure, manage and reduce their environmental impact and can be communicated to consumers to incentivise sustainable purchasing
<p>Consumer preferences data</p>	<ul style="list-style-type: none"> Data is collected from different dimensions, including domestic food waste and, the more commonly used, supply chain and transactions Insights generated through AI algorithms can help uncover hidden behaviour patterns which can redefine consumer preference and better predict demand. Consumers can also be incentivized to modify their behaviours in exchange for cost savings, rewards, or improved purchasing experiences
<p>Supply Chain Data</p>	<ul style="list-style-type: none"> Data is collected on food safety and quality, manufacturing capacity, production volumes, sales, and supporting the communications and logistics needs of food supply chains This can help achieve supply chain efficiencies and reduce waste at all stages by enabling efficiency in production processes, warehousing and distribution
<p>Waste Management Data</p>	<ul style="list-style-type: none"> Food consumption data can be used to design solutions (e.g., size of food portions supplied for takeout) to tackle food waste and save costs for both sides. AI algorithms leverage data on expiry dates to provide dynamic pricing on perishable products can reduce waste whilst boosting revenues.

Globally, government and businesses are innovating to incorporate data and digital in their food systems



We engaged with stakeholders across emerging and developed markets to identify companies we could derive lessons from for policymakers, entrepreneurs and potential investors. We found that LATAM, Africa and Asia are beginning to explore ways of establishing inclusive business models with tangible impact on food systems. The case studies spotlighted help readers to understand the role that government played in supporting or enabling this business model.



Data & Digital Solutions driving innovation in food systems

CASE STUDY DEEP DIVES



The LATAM story

Latin America has recently taken interest in the potential contribution of the ethical use of big data and Artificial Intelligence for economic development

Government-led or supported schemes and incentives

Country-specific initiatives

-  2018: The government evaluated an AI Platform in sourcing Aquaculture sector information with the aim of formally incorporating the platform into the relevant ministry
-  2019: The government started developing the Artificial Intelligence National Plan to foster favourable conditions for AI development and adoption in different sectors
-  2019: The government held the first congress of Big Data in Agricultural Innovation*, engaging with different actors to explore the potential for the modernization of agriculture

2007 - 2014

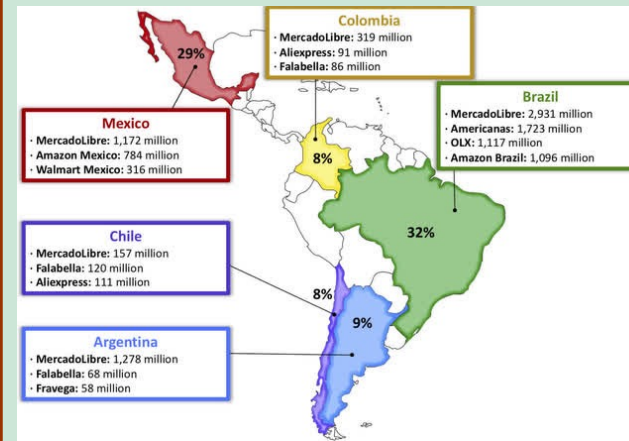
-  2020: The Digital Economy Partnership Agreement with New Zealand and Singapore was signed; this will promote digital inclusion, inclusive trade and support for SMEs
-  2021: The Personal Data Protection Law was passed, covering data subject rights, data security requirements and a fining scheme
-  2021: The government started working on the National Artificial Intelligence Policy; the policy will address socioeconomic opportunities of AI and ethical impacts of its use

2015 - 2019

2020

Latin America

- 2020: The Digital Agenda for Latin America and the Caribbean (eLAC, 2020) was written to catalyse regional cooperation on digital issues and achieve an inclusive digital transformation
- 2020: Rapid growth of e-commerce in Latin America, with agricultural e-commerce and hyperlocal supply chains increasing during the COVID-19 pandemic which expanded access to essential food supplies, perishable produce and semi-prepared and prepared foods



IMPACT ON ENABLING ENVIRONMENT FOR DATA AND DIGITAL INNOVATIONS

- ✓ Incentivizing private sector actors to invest in infrastructure and digital solutions for the unconnected population
- ✓ Promoting regional cooperation and collaboration with private sector actors and international organizations to encourage cross-regional initiatives in areas such as AI
- ✓ Instituting data protection frameworks to protect consumers as data and digital innovations pick up pace

Sources: Invest Chile, [Chile to have a National Artificial Intelligence Policy](#), 2021; New Zealand Foreign Affairs & Trade, [The Digital Economy Partnership Agreement is a new initiative with Chile and Singapore](#), 2021; OECD, [IBM Watson AI Pilot](#), 2020; OECD, [Artificial Intelligence National Plan](#), 2021; FAO, [Food systems and COVID-19 in Latin America and the Caribbean](#), 2020; iapp, [El Salvador passes Personal Data Protection Law](#), 2021; FAO, FAO and El Salvador's Government hold the first congress of Big Data in Agricultural Innovation, accessed 2021; Seeking Alpha, [MercadoLibre: A Tale Of Two Markets](#), 2020; FAO, [Food systems and COVID-19 in Latin America and the Caribbean](#), 2020

Notes: * The IBM AI Platform; **Held in collaboration with FAO

LATAM demonstrates that existing e-commerce platforms can play a role in creating sustainable food systems in partnership with food manufacturers

Lessons Learnt

Digital



- Innovative use of data and digital technology can involve private companies in delivering social good. Simultaneously tackling challenges of food waste and food insecurity, whilst facilitating and incentivizing cooperation between the private and charitable sectors and the huge capacity for growth of models that don't depend on consumer purchasing power

Data



- Innovative use of data can help to streamlining supply chain infrastructure, bringing large numbers of suppliers and consumers into a single network, and massively increasing efficiency as a result. Despite having drastically different models and objectives, both have been successful by acting as the intermediary in a network of suppliers and consumers. Consolidating supply chain logistics into this single network can reduce costs for the benefit of all

Enabling Environment

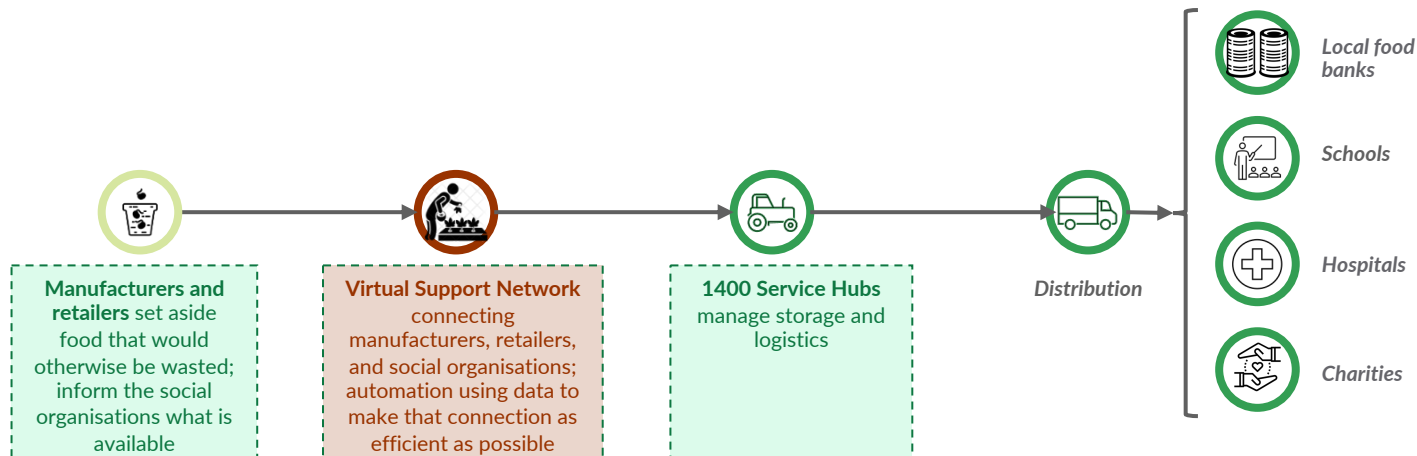
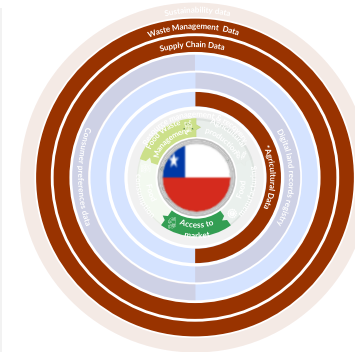


- Existing e-commerce platforms are well positioned to leverage their distribution networks for food delivery - by providing a set of cross-cutting services for consumers and suppliers alike (e.g., logistics, payment, and credit services, among others) they can break down various barriers to growth and play a key role in driving the expansion of digital engagement in Latin America

Red de Alimentos established a network of companies and social partners, delivering food that would have been wasted to vulnerable consumers

Overview

- Millions of tonnes of food are thrown away each year in Chile, with more than half of this wastage coming at the manufacturing and retail stages, as still-edible food is destroyed after going unsold.
- Since 2010, food bank Red de Alimentos has worked with private companies and social organisations to deliver food and other essential products that would have been wasted to schools, hospitals, and vulnerable families.
- This network now spans 245 companies and 462 social organisations nationwide, and the launch of a virtual network in 2018 has harnessed data and digital technologies to further streamline this value chain, connecting participants directly and facilitating the sharing of transport and storage infrastructure.
- This virtual network was developed with support from a range of tech companies and major retailers, including Google, Walmart, and many more.



During the COVID-19 pandemic, Red de Alimentos aligned with the Ministry of Social Development to deliver emergency food parcels to 125,000 families in Chile. The passing of a tax reform in February 2020 incentivising the delivery of products that would otherwise have been wasted also allowed Red de Alimentos to expand its operations.

Impact achieved

- 260,000**
vulnerable consumers reached in 2020
- 17,000**
tonnes of CO² saved in 2020
- 11,000**
tonnes of food rescued in 2020
- 1,400**
service hubs nationwide managing logistics

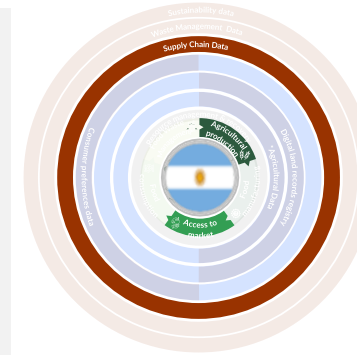
Key success factors

- Physical infrastructure
- Social movements
- Partnerships
- Digital connections

Mercado Libre is leading the expansion of e-commerce, logistics, and financial services in Latin America, with a growing focus on food

Overview

- Founded in Argentina in 1999, Mercado Libre is now the largest e-commerce platform in Latin America, across 18 countries,
- Mercado Libre has also branched out into other services, including logistics (assisting sellers with delivery and warehousing) and payments (providing an integrated digital payments platform, initially exclusively for its own marketplace, but increasingly for third parties too)
- Food had previously represented only a small section of the products sold via Mercado Libre, but since 2019 its 'Supermercado Libre' service in partners has been rolled out in Argentina, Brazil, and Mexico, providing an online supermarket able to deliver food rapidly to consumers.
- They have also established an advanced data platform which leverages Tableau and Alation to create a seamless process of data discovery and analysis with the goal of enabling all its 7,500+ employees with self-service analytics



Impact achieved

132 Mn
unique active users

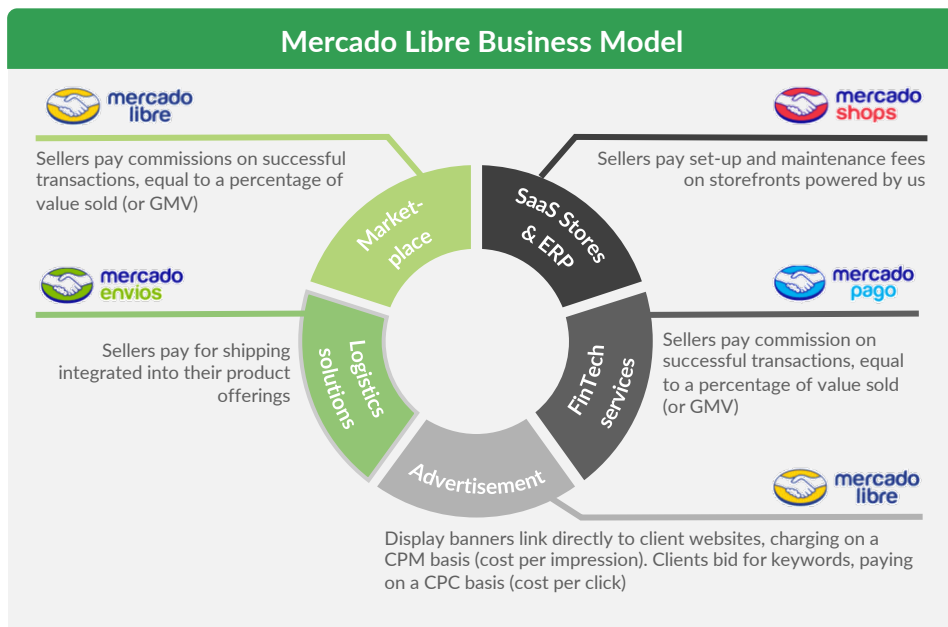
57,5 Mn
new users in 2020

400%
Increase in sales of groceries in 2020

86%
Ownership of the e-commerce market in LATAM

Key success factors

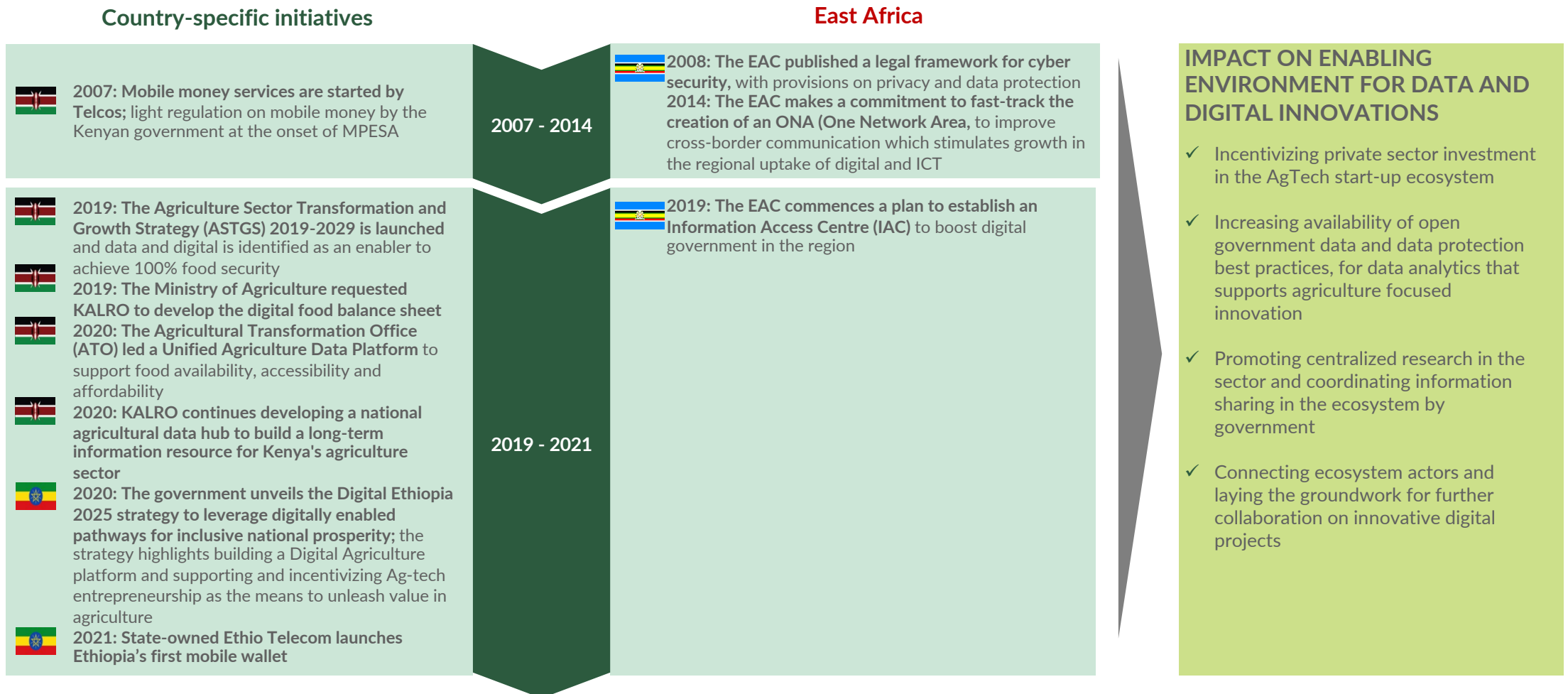
- Established data architecture
- Digital payments infrastructure
- Partnerships



The Africa Story

In Africa, Kenya and Ethiopia are driving data and digital innovation with a strong government focus on including small holder farmers

Government-led or supported schemes and incentives



East Africa demonstrates that collaboration across public and public sector is a critical enabler for data and digital innovation in food insecure markets

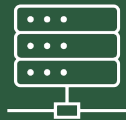
Lessons Learnt

Digital



- Digital platforms can be inclusive and scalable for smallholder farmers, generating the data needed to enable critical services including access to finance, inputs, learning and markets
- Digital innovation can inform food systems of relevant needs in real-time, by responding to production needs as they occur to lower market risks and promote investment
- Smart food markets can be inclusive for both farmers and consumers, providing voice and engagement that can make markets more responsive, safe, healthy and affordable
- Digital innovations supporting access to markets are still nascent and require trials and strategic support

Data



- Twiga's "Farm to Fork" model leverages data across the food system to reduce food waste, increase efficiency and production, lower prices and drive inclusive food system engagement by farmers and consumers
- The ATO is leveraging data generated by private sector actors to drive development of a national agricultural data platform to respond to shocks and drive food security

Enabling Environment

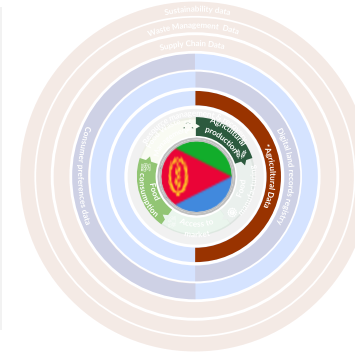


- Transforming the access to agriculture data needs better coordination and lesson sharing across . This helps to embed a data driven approach and build a culture of data production and use
- Transforming access to agriculture data needs more and improved financing, especially through domestic government funding. This is a key ingredient to allow prioritized investment in foundational/core systems to allow building of innovative solutions

Ten years of ATA programming has led to consolidating 17 digital data sets into one data hub to drive strategy, innovation and impact for smallholder farmers

Overview

- Despite rapid network growth and gradual regulatory change in Ethiopia, digital services remain nascent and SHFs have low access to these services
- The Ethiopian Agricultural Transformation Agency (ATA) supports partners to **identify and integrate solutions to address systemic bottlenecks in agriculture.**
- ATA developed a digital strategy which set out to leverage ATA's data for impact
- A Data Hub was developed as part of the strategy. The first version was able to centralize and consolidate existing ATA data sources to provide data insights, deliver enhanced advisory services to farmers and enable improved agent support.
- ATA's vision for the Data Hub is to consolidate all data within the ATA into a single location, leverage consolidated data across all ATA initiatives, and expand access to the Data Hub to partners



Impact achieved

5,6 Mn

farmers reached by 8028 IVR solution

31,000

FPCs supported by ATA, consisting of 3.45 M farmers. Land cultivated: 2.7 M hectares

9 Mn

Farmers supported in Locust response leveraging ATA data

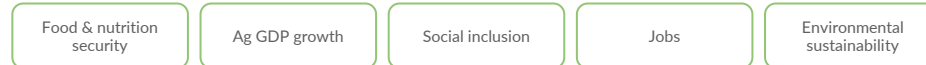
> 11,000¹

jobs created through agri collaboration

The Data Hub is now being leveraged to:

- Provide insights** for policymaking, program design and implementation, correlating across data sets to create significantly greater insights
- Support precision agriculture** services to improve farmers decision making, productivity and income across agricultural clusters
- Help farmers build, protect and leverage economic identities** and access financing
- Allow public and private sector to plug in** to the platform, access data and connect with farmers

Macro D4Ag Impacts



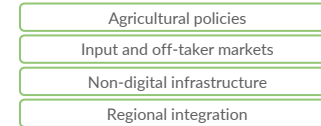
Smallholder Farmer D4Ag Impacts



Nat'l D4Ag Adoption

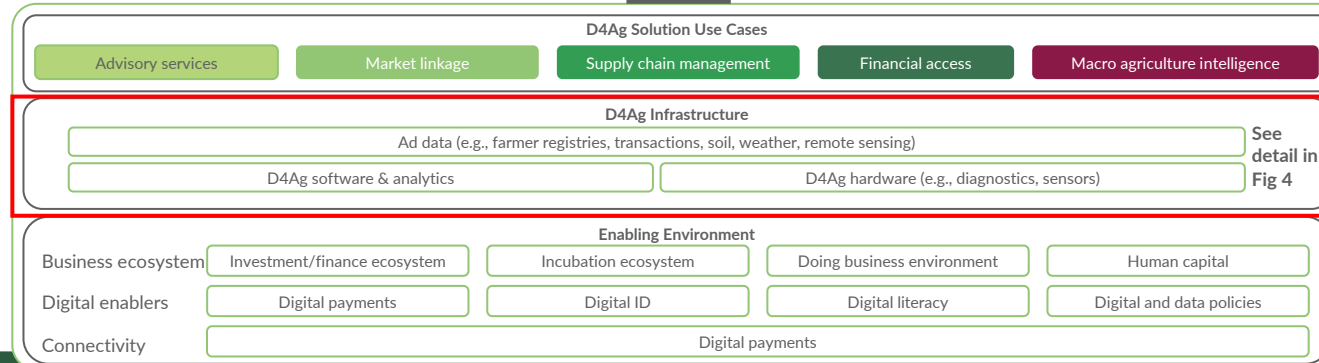
D4Ag Reach & USE

Other Ag Transformation Drivers



Data supports decision-making

D4Ag Ecosystem



Key success factors

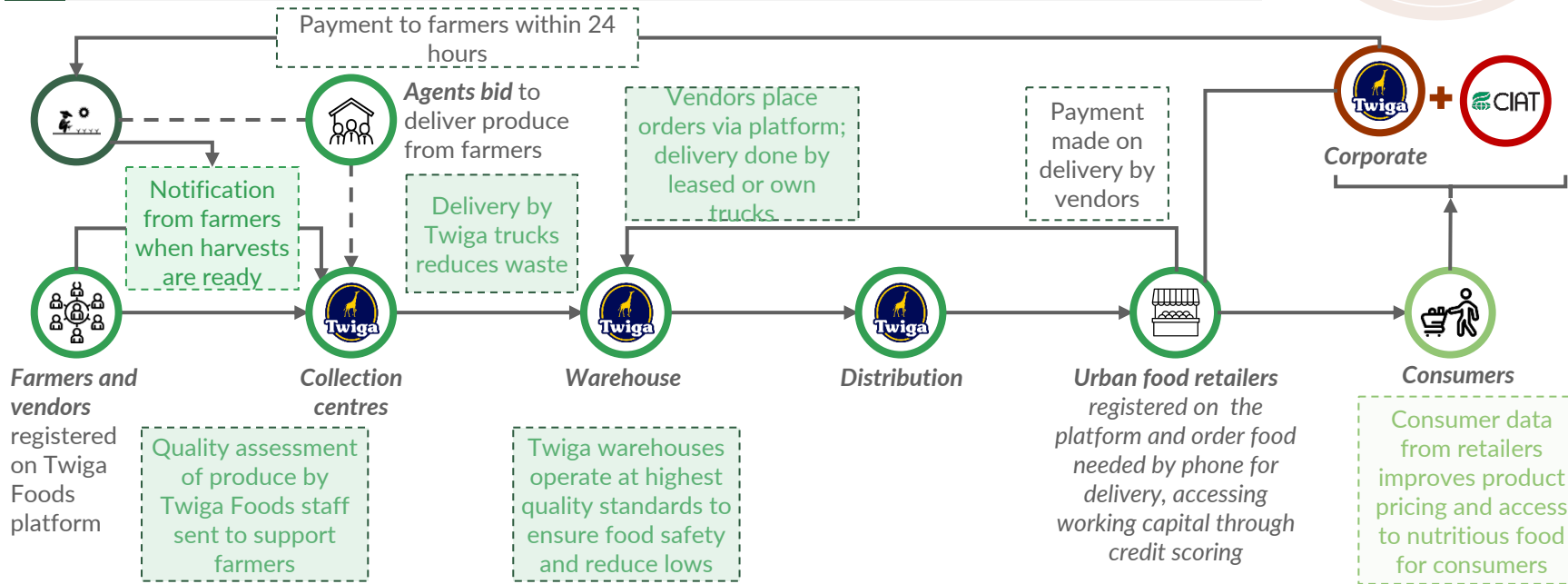
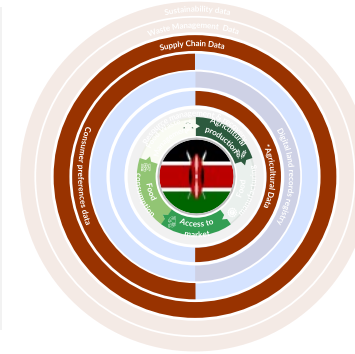
- High expertise in digital solutions
- Strong reputation of ATA
- Amount of existing data and farmer reach

The Government of Ethiopia is the key player in the ecosystem, primarily driving productivity gains and operating Africa's largest extension system.

Twiga Foods has increased food security by leveraging digital data from urban retailers and producers to create more access to nutritious food

Overview

- Agricultural supply chain inefficiencies and fragmented markets contribute to high food prices and 5,2 million tonnes of food waste per year in Kenya
- In 2014, Twiga Foods was launched to contribute towards food security and increased access to nutritious food by:
 - Providing farmers with higher returns for their produce
 - Supplying consumers with affordable high-quality produce through an efficient, safe, transparent and formal marketplace
- Working with CIAT, Twiga developed two data applications to increase supply of nutritious food in urban slums



The Government of Kenya actively supported Twiga Foods as a model to drive food security. Their backing was critical in helping Twiga secure USD 10M investment from International Finance Corporation (IFC) in 2018c

Note: *33,000 monthly
Sources: UNEP, Food Waste Index Report, 2021; Dalberg Analysis

Impact achieved

- 9,000**
urban food retailers supplied daily*
- 83%**
post-harvest loss reduction
- 17,000**
farmers reached
- 30%**
average income increase for farmers

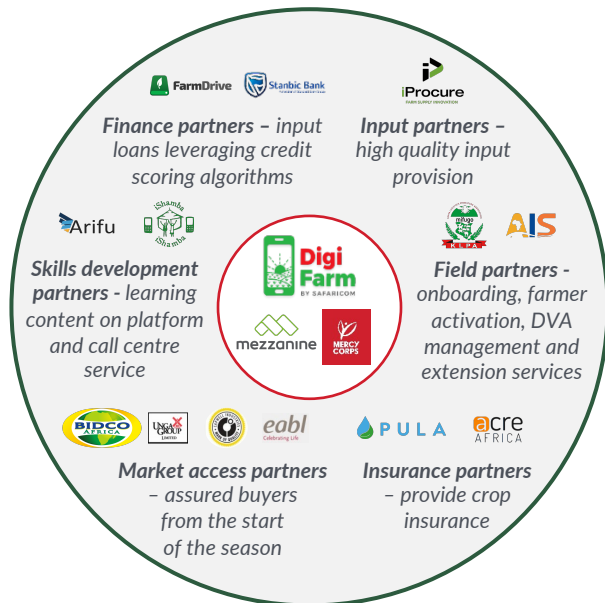
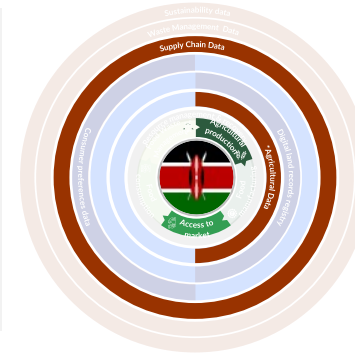
Key success factors

- Infrastructure investment
- Quality control
- Partnerships
- Consumer data

Safaricom's DigiFarm platform has pioneered inclusive services for 1.4 million smallholders with finance, inputs, learning and market access

Overview

- In 2015, SHFs accounted for over 85% of agricultural output nationally, however they struggled to access affordable quality inputs for farming, and lacked technology to boost agricultural productivity resulting in most farmers earning less than USD2,50 per day
- In 2017, DigiFarm was launched as a bundled services platform supporting AgTech innovators that would leverage digital and data to scale inclusive finance, enable access to improved inputs, farmer learning, critical services and market access for smallholders
- The platform, developed with Mezzanine, is supported by Mercy Corps as an innovation partner, backed by Gates & MasterCard Foundations, showing value of development agencies to drive inclusive solutions



Inputs	<ul style="list-style-type: none"> Customised package based on soil testing, value chain & potential yield Link between farmers to local distributors
E-subsidy	<ul style="list-style-type: none"> Access to subsidies provided by the Ministry of Agriculture through the platform
Inputs & Credit	<ul style="list-style-type: none"> Pre-planting loans for inputs and farm labour costs Cash loans for harvest and transportation of produce
Learning & information	<ul style="list-style-type: none"> Digital learning content & call centre with agriculture experts In-person extension services to help maximise yields
Insurance	<ul style="list-style-type: none"> Agri-insurance coverage on full yield for farmers Minimises weather-related risks
Aggregation & delivery	<ul style="list-style-type: none"> Aggregation of crops to specific locations and times Delivery services from aggregation to buyer and tractor renting services
Enterprise product	<ul style="list-style-type: none"> Access to products and services available on the platform to organisations that have direct contact with farmers
Market access	<ul style="list-style-type: none"> Links farmers to specific buyers Contract model guarantees the purchase at an agreed price point

DigiFarm has enabled the Ministry of Agriculture to provide e-subsidies to farmers, leveraging private sector innovation to provide government support to smallholders, lowering the costs of subsidy distribution. KALRO and DigiFarm also partner to provide satellite driven weather and agricultural advisory services

Impact achieved

48% women

female farmers active

67,514

input loans leveraging data

96%

engagement on digital learning content

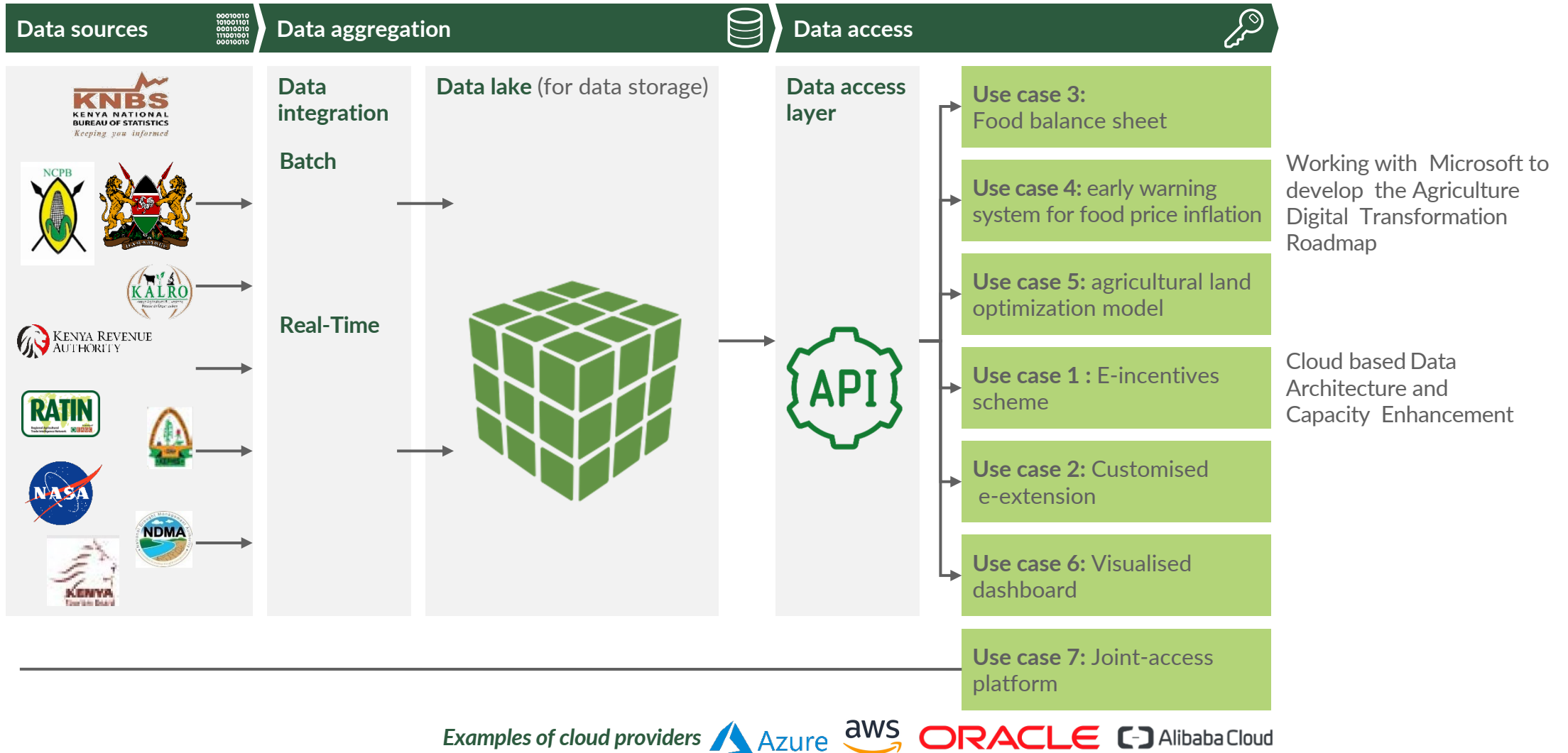
2,346 MT

*produced across 5 value chains**

Key success factors

- Farmer knowledge
- Partnerships
- Mobile money penetration
- Donor & technical support
- Brand presence & trust

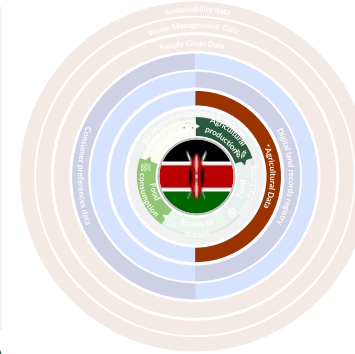
The Kenya Agricultural Transformation Office is leading a Unified Agriculture Data Platform to support food availability and stable prices



The Agricultural Transformation Office uses data from the Kenya Unified Agricultural Data Platform to coordinate outcomes across multiple players

Overview

- In early 2020, the COVID-19 pandemic exacerbated an existing food insecurity crisis in Kenya; with the immediacy of lockdown protocols also meant limiting the regular flow of and access to food.
- A team of data experts comprising government and non-government volunteers came together to co-create data driven solutions that enabled the Ministry of Agriculture to have access to reliable and accurate data on the availability of food staples in all the 47 counties.
- A total of 26,134 respondents were reached during the survey over the two months. The data was collected and aggregated in a Food Staples Dashboard, which provides analytics by staple, quantity, price and the location and geographic distribution of the produce.



Impact achieved

23,1634

respondents surveyed

185

issues directed to the hotline were resolved

Ministry of Agriculture was able to develop guidelines on food availability and food prices that were rolled out across the country.

Development Partners



Private Sector players



Government Agencies & Associations



The Food Security War Room (FSWR) within ATO has coordinated ~50 critical stakeholders nationally to ensure that there was availability, accessibility and affordability of food, and support to farmers during the crisis. Finally, FSWR worked with stakeholders to Maintain agricultural output and value addition (e.g., support operations of large farms and processors, and limit disruptions to markets including for export)

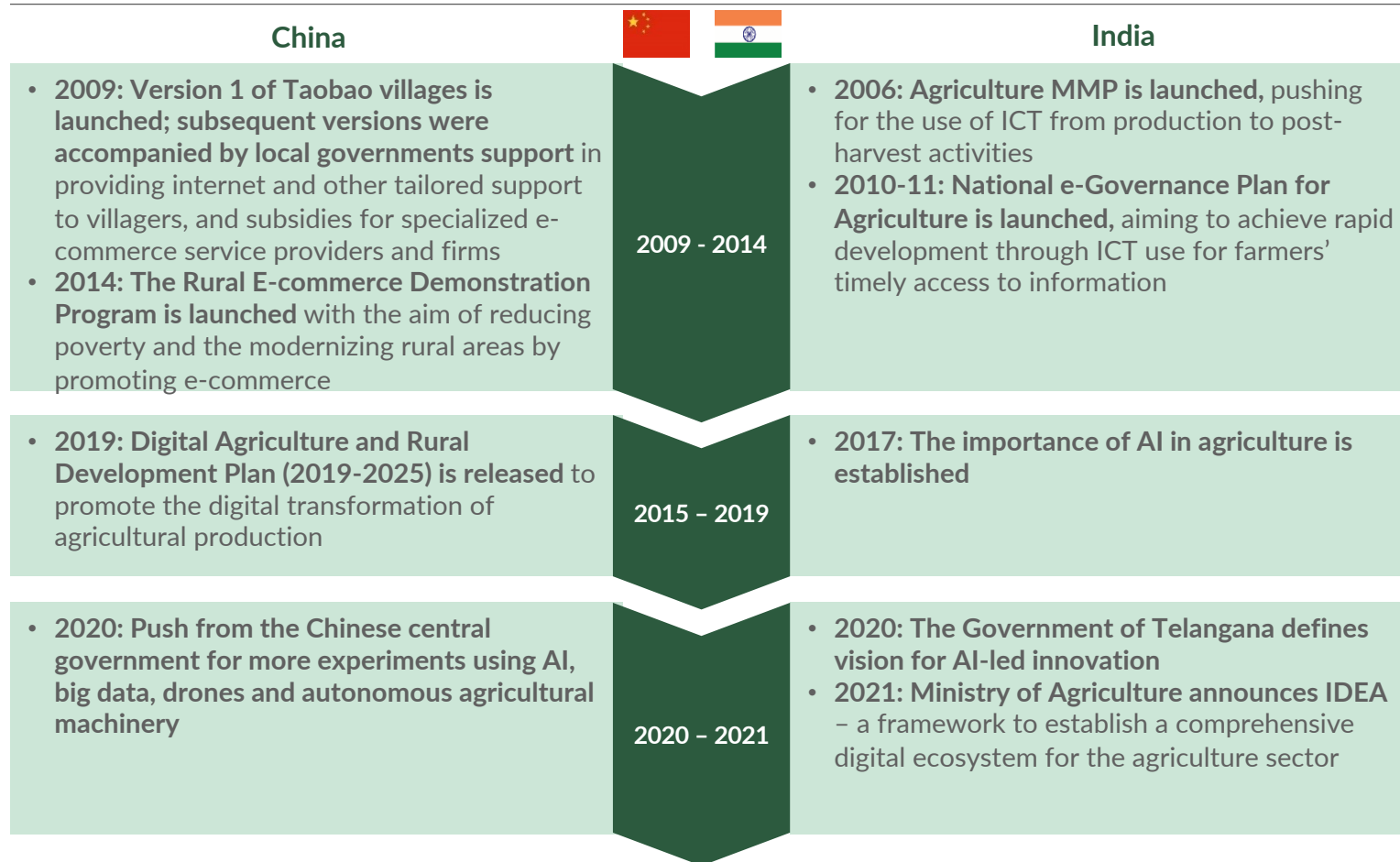
Key success factors

- Existing mechanisms from MoALFC
- Partnerships

The Asia Story

Over the past decade in Asia, China and India have enacted several schemes and incentives to promote digital and data innovation for agriculture

Government-led or supported schemes and incentives



GOVERNMENT CONTRIBUTION TO AN ENABLING ENVIRONMENT FOR DATA AND DIGITAL

- ✓ Incentivising private sector investment in building more efficient food supply chains
- ✓ Enabling public-private data sharing to enhance availability of good quality and reliable data to facilitate development of AI-based solutions
- ✓ Transforming rural internet infrastructure to increase reach of digital agricultural solutions to boost productivity

Sources: World Bank Blogs, [E-commerce for poverty alleviation in rural China](#), 2019; Ministry of Agriculture and Rural Affairs, [Development Plan for Digital Agriculture and Rural Areas](#), 2019; Xinhua, [Yearender: Intelligent technologies drive China's agriculture modernization](#), 2021; PIB, [National e-Governance Plan in Agriculture](#), 2021; WEF, AI4AI, 2021; Department of Agriculture and Farmer's Welfare, [Consultation Paper on IDEA](#), 2021

Asia demonstrates that consumer buy-in and physical infrastructure (ICT, logistics) are the backbone for scaling digital marketplaces

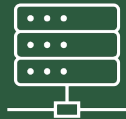
Lessons Learnt

Digital



- Digital platforms can build consumer trust and elevate usage by both farmers and consumers, improving market linkages between the two groups
- Offering a more socially engaging consumer experience, which integrates behavioural insights into the user experience – maintains consumer engagement, especially through ‘window shopping’ and social engagement
- Ensuring that there is sufficient human capital to apply and monitor digital innovation is crucial in precision agriculture

Data



- Consumer data can enable food suppliers to accurately meet consumer needs (and support farmers to understand required production volumes and quality demanded) which lowers costs further at the midstream and downstream and gives the opportunity to innovate and invest in new fulfilment modes of consumers
- There is a need to focus on data protection law to ensure digital security and privacy, especially for SHFs

Enabling Environment

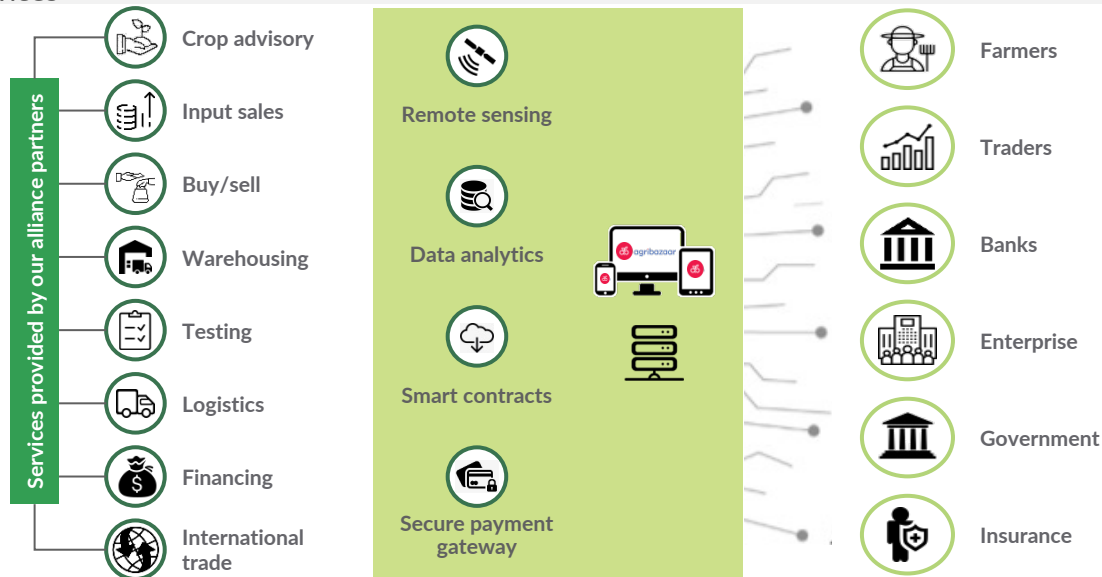
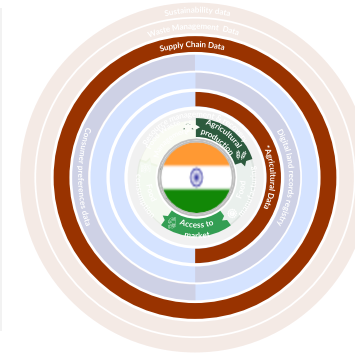


- Government can play a critical role in building consumer trust through enabling logistics providers to ensure agricultural produce could still be transported
- Existing physical infrastructure, policies such as ensuring low payment fees and a framework to improve agri-value chains (cold chain and logistics) is important enabling environment for digital innovations to scale
- It is important to establish mechanisms for effective engagement of farmers in the decision-making and in defining value

Agribazaar delivers price transparency, traceability of crops and distribution efficiency for small holder farmers through an online platform

Overview

- India's agricultural sector is hindered by poor supply chain infrastructure, fragmented distribution and limited linkages to off-takers and end-consumers which result in ~ USD 1,427 loss in revenue for farmers due to post-harvest losses
- In 2016, Agribazaar was launched as an online marketplace connecting farmers to market; they have since evolved to an online platform offering pre- and post-harvest services through a range of alliance partners¹
- Agribazaar utilises Artificial Intelligence, Machine Learning, big data, Internet of Things, and drones in providing a range of services, including real time advisory services and digital financial services



In 2021, Agribazaar signed an MOU with the Union Agriculture Ministry to develop and implement a digital agriculture platform with solutions in the field of crop identification and estimation using remote sensing technology, advisory services to farmers, post-harvest intelligence, market connect and providing financial access to the farmers.

Sources: Economic Times, [Indian farmers face Rs 93,000 cr post-harvest loss](#), 2020; Outlook, [Agribazaar inks pact with govt to promote digital agriculture in rural India](#), 2021; Compendium on Emerging Technologies for Agriculture; YOURSTORY, [This agritech startup aims to empower India's 126M small farmers with technology and data](#), 2021; Dalberg analysis 2021

Impact achieved

155,000
users

USD 2,342 -
3,010
annual income opportunity
for village youth

USD 1 B
transactions facilitated via
AgriPay since 2017

1.5 - 2.5%
reduction in agri-trade
commissions

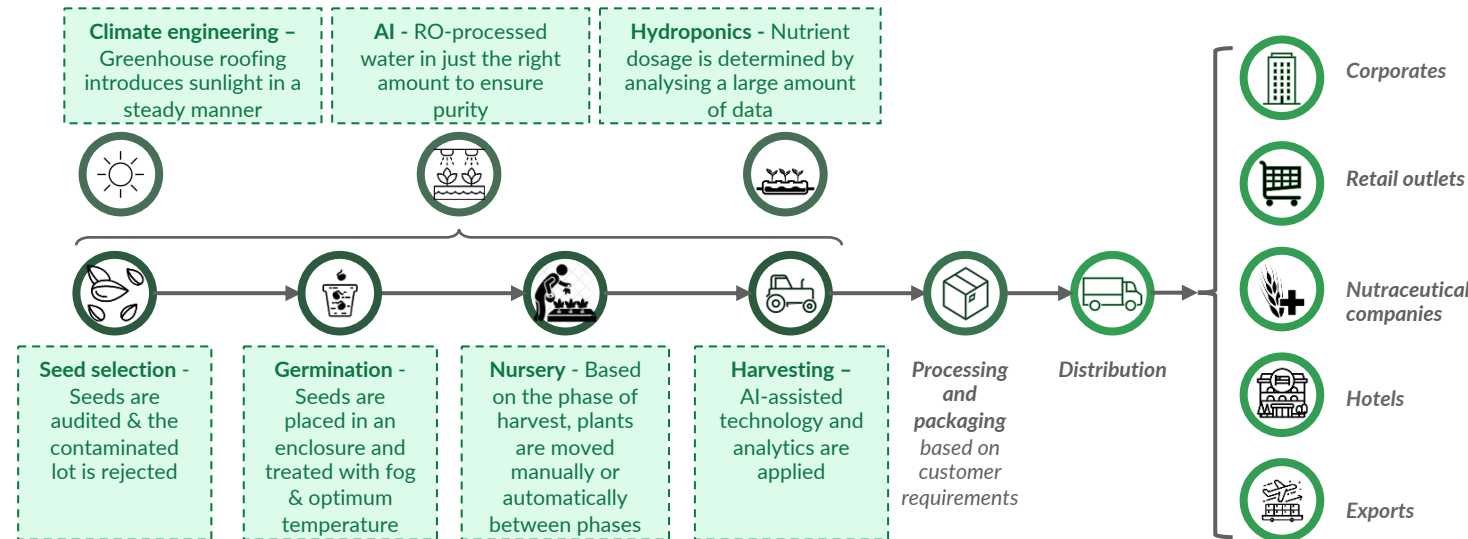
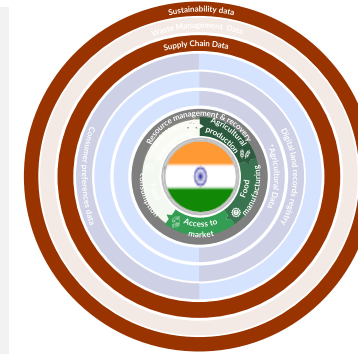
Key success factors

- Free services for farmers
- Investment in R&D
- Customer acquisition marketing
- Partnerships

Simply Fresh delivers food safety and traceability in the food value chain with the aid of sustainable farming practices and AI

Overview

- Conventional farming in India usually employs techniques, inputs and equipment that are relatively inefficient, often resulting in lower yields
- Launched in 2013, Simply Fresh operates 140- acre and 9-acre precision farms, that have contributed towards food security and safety by supplying fresh produce to market year-round that is safe and free from pesticides, herbicides and contamination and is produced using sustainable farming practices
- Using a proprietary software (Farm in A Box) that integrates AI-assisted technology and analytics, Simply Fresh harvests high quality produce for further processing or consumption
- They also assign QR codes on produce packaging enabling traceability from farmer to consumer



The Government of Telangana has been at the forefront of enabling a conducive innovation ecosystem in agriculture by enabling digital agriculture initiatives, including the AI4AI pilots in five districts of the State focusing on intelligent crop planning and sowing, smart farming, farmgate -to-fork, and data-driven agriculture.

Impact achieved

140+
value chains

90% lower
electricity & water consumption than traditional practices

15-20 times
more yield than traditional practices

5 cities
India presence

Key success factors

- \$ Investment
- 🔍 Intrinsic R&D
- 🤖 Automation
- 📄 Quality assurance

Sources: Simplyfresh.Co.In; Financial Express, [Simply Fresh: The start-up grows a full line of medicinal plants leveraging AI](#), 2020; Dalberg analysis 2021

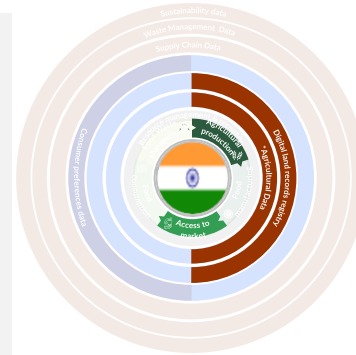
IDEA is a unifying platform for digital agriculture, being developed by the Ministry of Agriculture and Farmers Welfare

Overview

- Most farmers in India are small and marginal farmers with limited access to advanced technologies or formal credit that can help improve output and fetch better prices.

IDEA – India Digital Ecosystem of Agriculture

- seeks to ‘transform farming’ by leveraging the power of data and digital technologies
- enables creation of secure, interoperable and innovative solutions by the public and private sectors, across the agriculture value chain.
- supports objectives like food and nutritional security, optimal use of natural resources, enhancing productivity and profitability of farming, and effective risk management.



1. What are the building blocks of IDEA?



- **CORE** building blocks, that include registries, directories, master data, consent manager, security and privacy
- **COMMON** building blocks, like real-time price information, direct transfer of benefits to farmer, weather prediction & advisories, digital markets

3. Potential Challenges



- Quality of land records and digitization
- Protection of personal data & privacy
- Ensuring that the benefits of technology are distributed equitably

2. What are the proposed benefits?



- Enablement of farmers to take informed decisions
- Improved access to formal credit & insurance
- Better quality of inputs, advisories and logistics
- Realtime price discovery and smooth connect to markets

4. Recommendations

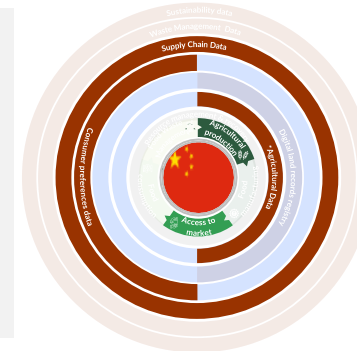


- Establish mechanisms for effective engagement of farmers in the decision-making and in defining value
- Focus on data protection law to ensure digital security and privacy
- Think Big, Start Small, Scale Fast

Alibaba Group's digital ecosystem serves rural farmers and consumers through Taobao's e-commerce platform and value added services for farmers

Overview

- Launched in 2003, Taobao Marketplace provided the space for urban consumers to get access to large listing of products and services, and connect with other consumers, brands and retailers
- However, considering the growing urban-rural divide and with 40% of China's population in rural areas, the Alibaba Group and the government launched the Rural Taobao program in 2014
- Rural Taobao helps farmers earn more by selling agricultural produce directly to urban consumers. Rural Taobao also serves the rural consumer by providing them with access to the variety of goods and services available to urban consumers at equal prices
- Leveraging Alibaba's existing digital technologies and on-the-ground network, Rural Taobao also improves farmers' productivity by providing advisory services, linkages to farm inputs, and financial products



Impact achieved

100 Mn
mobile monthly active users
as at May 2021

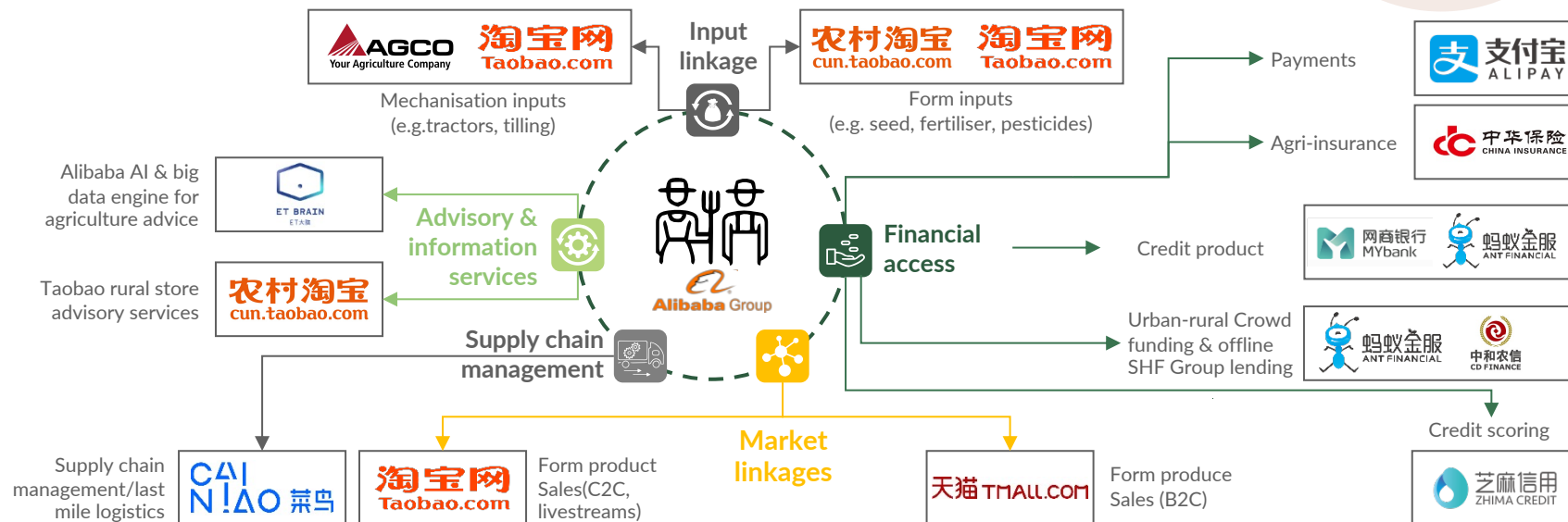
3.387 Tn Yuan
Gross Merchandise Value in
2020

2 Bn
listings of products and
services

58.2%
domestic e-commerce
market share

Key success factors

- \$ Investment
- Infrastructure
- User experience
- Government support



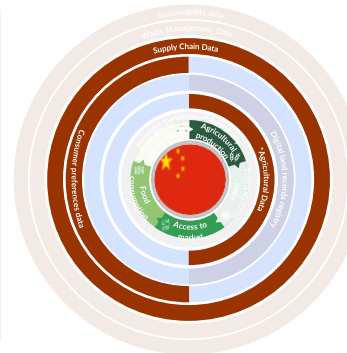
Local governments have supported the growth of Taobao villages* by providing infrastructure support, e-commerce training, and finance. More recently, local governments provide subsidies for specialized e-commerce service providers and firms to build an e-commerce ecosystem with e-platform companies.

Sources: World Bank Blogs, [E-commerce for poverty alleviation in rural China](#), 2019; TheStar, [How Alibaba's Taobao solved the trust problem in China and changed the way people shop](#), 2018; TONG, [Taobao: China's Super Ecommerce App](#), 2021; CTA and Dalberg, [The digitalisation of African Agriculture Report](#), 2019; Dalberg Analysis 2021. Notes: *A Taobao village is a village with a large number of online merchants that do business mainly through Taobao.com, depend on the Taobao ecommerce ecosystem, and achieve economy of scale and synergy.

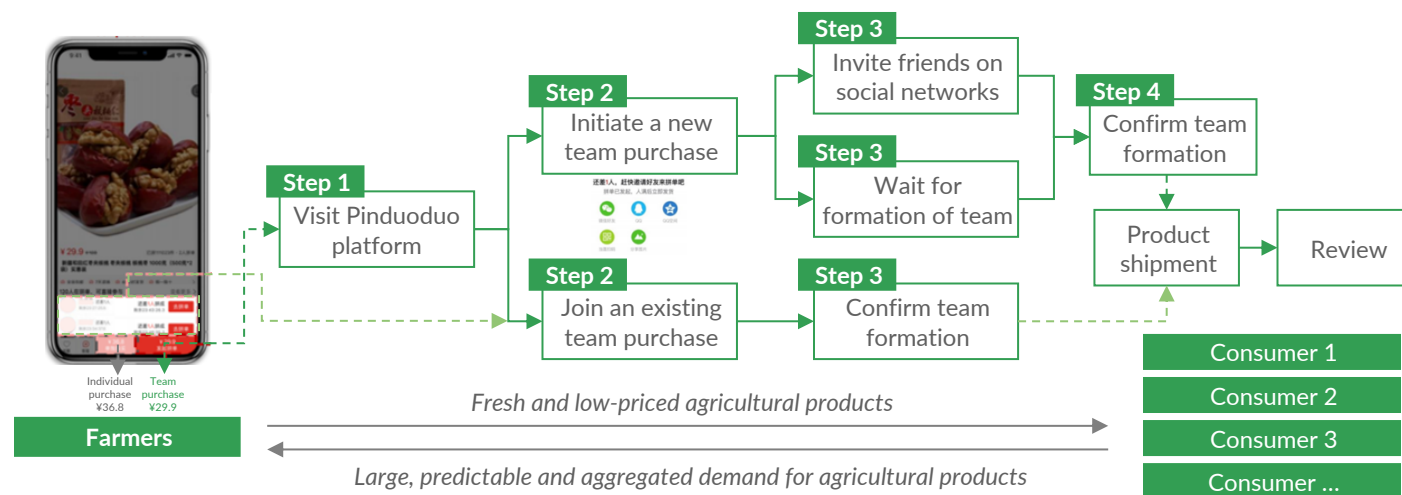
Pinduoduo has redefined agri-food e-commerce at the same time as empowering farmers and consumers through digital platforms

Overview

- Launched in 2015, Pinduoduo leveraged the rise in mobile internet and e-wallets to reinvent the marketplace model and plug a gap in using e-commerce for fresh produce.
- They provide a direct sale platform for farmers to consumers – building on the strong Chinese infrastructure and logistics. And as supply and demand became more digitized with growing sales volumes, Pinduoduo worked with farmers so that they could grow and market more efficiently and improve quality of products, making the whole supply chain more efficient and reducing waste
- By aggregating consumers' demand, Pinduoduo enabled farmers to sell in large volumes directly to consumers across China, allowing consumers to enjoy lower-than-retail prices while farmers grow their incomes



Team Purchase Model- Interaction between users to aggregate demand and cut costs



The Chinese government supported the development of factors that allowed agri-food e-commerce to take off- existing physical infrastructure, policies such as ensuring low payment fees and a framework to improve agri VC (cold chain and logistics).

Sources: AgFunderNews, [Pinduoduo overtook Alibaba. Now it's focused on foodtech to hit profitability](#), 2021; Singapore Management University, [Pinduoduo: Driving E-Commerce in Rural China to Improve Farmers' Livelihoods](#), 2020; Pindoudou, [Pinduoduo: Empowering farmers with an e-commerce platform](#), 2021

Impact achieved

788mm
active buyers in 2020
(35% YoY growth)

100,000
new farmers
(young entrepreneurs)
trained since 2015

586K
agri-merchants as f 2019
(141% YoY growth)

270 billion Yuan
\$42 billion in agriculture-
related GMV, up from 136
billion yuan in 2019

Key success factors

- Investment in technology and RnD
- Mobile penetration (existing apps), accessibility and connection
- Farmer knowledge
- Consumer engagement



Mainstreaming Digital Marketplaces

THE WAY FORWARD



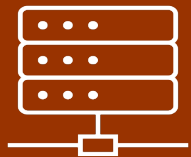
The 30 business models and 12 global case studies reviewed, identified innovative approaches for mainstreaming inclusive data & digital marketplaces

Digital



- Digital platforms can be inclusive and empowering for farmers and consumers, providing safe and straightforward access to markets, as well as generating data to support productivity, sustainability, and traceability throughout food systems
- Smart food markets can help enable innovative supply chain models that provide farmers and consumers with greater agency, facilitating more direct pathways for supplying safe, healthy, and sustainable food at a fair price for all
- E-commerce and online trading platforms are well positioned to provide cross-cutting financial and logistical services to consumers and suppliers alike, although adequate protections must be built into the design of all such services
- Innovative digital solutions leveraging IoT, and AI hold significant potential to promote climate-smart farming practices and reduce food waste at all stages of the supply chain, but require considerable further investment

Data



- Multiple stakeholders must work together to build relevant agricultural data sets to support sustainable food systems, by coordinating data harmonization, collection and sharing efforts with informed consent of consumers and farmers
- On-going lesson sharing to embed a data-driven approach is crucial to ensuring that all data collection and usage is beneficial for national and global food systems, as well as the people within them
- Consumer data can enable food suppliers to effectively meet demand for healthy, safe, and sustainable food, while innovative approaches to data management and stewardship are needed to ensure this is done fairly and equitably

Ecosystem Enablers



- Governments have a crucial role to play in connecting sustainable and inclusive supply chain models with public and private investment, as well as creating an enabling environment to encourage data and digital innovation that centres the needs of people and planet
- More capital is required for start-ups and for foundational/core ICT systems that enable innovative applications and services (especially for advanced data analytics at a national level)
- Instituting data protection frameworks for consumers, and clear agriculture policies that incorporate food safety, nutrition, and sustainability, will significantly strengthen data and digital innovation as a force for good


Across the case studies, three opportunities emerge as a starting point for encouraging data-driven, interconnected, digital innovation for sustainable and inclusive food systems

1 DIGITAL PLATFORMS FOR FOOD MARKETS AND SUPPLY CHAINS 

Digital platforms can host and integrate technologies, products and services for the benefit of farmers and consumers, developing sustainable supply chains for safe and healthy food. These platforms must be inclusive, providing market access for all, with proper safeguards in place

DAPs can promote private sector investment into digital platforms that maximize the benefit of innovation for consumers and small holder farmers, supported by marketplace and data standards

Examples of digital platforms include



2 COLLABORATIVE DATA MANAGEMENT 

Collaborative data management can build data-collection, integration and sharing capabilities within government institutions to host agriculture and food data for public good, while enabling private sector for scale. These can be established with innovative approaches to data stewardship and standards can ensure consumers and farmers are protected

Collaborative data management can facilitate collaboration across multiple stakeholders, streamline data sharing at national/regional level, while governments can act to ensure that data is used for the public good

Examples data sharing platforms include



3 INNOVATION HUBS FOR DIGITAL AND DATA BREAKTHROUGHS IN FOOD SYSTEMS 

National and/or regional innovation hubs can embed and partner with players in government, private sector and funders, to provide insight and practical support. Innovation hubs can help all stakeholders to build inclusive and sustainable food systems solutions that take farmer and consumer needs into account

Innovation hubs can facilitate technical and financial support to inclusive and sustainable solutions, and enable local entrepreneurs to learn and test both new and existing digital markets

Potential ecosystem partners could include





Digital Agriculture Platforms can help engage and enable partners across the agriculture ecosystem to maximize the scale and impact of digital innovations

1

DIGITAL AGRICULTURAL PLATFORMS

Where strong digital infrastructure, and private sector innovation exists, DAPs can drive adoption of digital applications and services for sustainable food systems.

Digital Agricultural Platforms can also:

- Provide access and donors to secure funding when needed for start-ups
- Create access to low-cost digital products for farmers and consumers
- Establish sustainable farming practices that improve agricultural productivity, address climate risk and the PHL risk
- Reduce waste by creating direct to consumer linkages that boost farmer profits and stabilize food prices
- Deliver price transparent markets, and reduce for farmers and consumers
- Enhance traceability for safe and nutritious foods for consumers
- Provide data-driven feedback to adjust policies on for sustainable food systems transformation



PUBLIC SECTOR SUPPORT

- Promote the development of digital applications and services to connect farmers and consumers more directly (B2B platforms, farmer to online retail network, grassroots local connects, group buying apps)
- Improve digital literacy skills of small holder farmers and consumers who stand to benefit
- Crowd-in investment as part of a longer-term strategy to build ecosystem partners



PRIVATE SECTOR SUPPORT

- Leverage private sector skills and capital in scaling up the design and development of responsible and customized technologies, solutions, and digital support services
- Promote the establishment of fair digital payments infrastructure to lower and improve efficiencies in financial transactions



ENABLING PARTNER SUPPORT

- Provide funding for developing digital agricultural platforms, especially in early stages where final offering may not yet be commercially viable
- Play a leading role in DAP partners to define partnership arrangements and understand overall benefit of establishing platforms
- Support DAP partners to maintain the growth and management of innovative digital solutions and infrastructure to support food systems transformation

Collaborative data management can help drive product innovation, climate-smart approaches, transparency, efficiency and inclusivity

2

COLLABORATIVE DATA MANAGEMENT

Where clear national strategies underpinned by agricultural data analysis for sustainable food systems collaborative data management can embed a culture of real-time data collection, integration and sharing.

Agricultural Data Centres can also:

- Promote and foster collaboration with public sector entities and private firms through open data-sharing for agriculture
- Pioneer the digitization of agricultural data and research in line with government priorities
- Promote evidence-based policymaking in agriculture sector to resource allocation towards local food production, nutrition outcomes & food security
- Build the data required to promote and support digital applications and services for consumer food waste management and reduction in emerging markets



PUBLIC SECTOR SUPPORT

- Establish data protection guidelines and data sharing schemes, which promote data privacy and ensure that consumers and small holder farmers have informed consent
- License data from consumer organizations' product testing back to producers, in order to enhance design quality and safety
- Build data-capabilities and infrastructure within government or quasi-government institutions to host agriculture and food data for public



PRIVATE SECTOR SUPPORT

- Support governments to establish internal technical teams such as software engineers and data analysts
- Provide agricultural data that would support governments data collection and data sharing efforts



ENABLING PARTNER SUPPORT

- Aggregate data from players (both private and public) to drive informed decision making and sectoral collaboration throughout the agriculture value chain and ecosystem
- Provide funding support to national hubs established by the government (in collaboration with private sector actors)
- Support governments to establish, monitor and evaluate impact of innovation hub's resources and capabilities on local solutions



Innovation hubs can spotlight local innovations, act as a conduit of capital, and create an enabling environment to support and test new solutions

3

INNOVATION HUBS FOR DIGITAL AND DATA BREAKTHROUGHS IN FOOD SYSTEMS

Where there is strong collaboration between public sector and other ecosystem actors, innovation hubs can align regional/national strategies for achieving sustainable food systems with local innovation.

Innovation Hubs can also:

- Act as a focal point for financial institutions to crowd in investment providing entrepreneurs with the capital to alleviate cashflow constraints as they scale up
- Provide established networks and relationships to build outreach to potential partners and policy makers
- Provide information and data from the field to inform their decision making and product development



PUBLIC SECTOR SUPPORT

- Establish and coordinate government ministries to effectively support innovation hubs and make it easy for entrepreneurs to access resources
- Develop policies (e.g., regulatory sandboxes) and incentives (e.g., challenge funds, subsidies, tax incentives) that will promote the development localized solutions for sustainable food systems



PRIVATE SECTOR SUPPORT

- Identify and establish new business partnerships from innovation hubs
- Consider providing suitable guarantees to enable identified innovation hub business partners to access growth capital at financial institutions
- Allocate financial capital, and technical resources to local innovation hubs



ENABLING PARTNER SUPPORT

- Donors, technical assistance providers and development partners (e.g., CIAT, Mercy Corps, Dalberg) should provide financial resources and advisory services to local players in digital and data innovation for agricultural food systems

Annex



Spotlight: Innovation Hubs for Digital and Data breakthroughs in food systems

	World Food Program Innovation Accelerator	World Economic Forum Food Innovation Hubs
Overview	<ul style="list-style-type: none"> In 2020, WFP established new Innovation Hubs in Kenya and Jordan. These hubs aim to localize their offering by identifying, piloting and scaling innovations for zero hunger in Eastern Africa. In Kenya, the WFP Innovation Hub for Eastern Africa secured US\$ 3.2 million in funding from the Danish Ministry of Foreign Affairs The hub launched two innovation programmes – a Bootcamp and a Sprint Programme – in collaboration with the Accelerator and established a partnership with the Hult Prize to support the next generation of entrepreneurs 	<ul style="list-style-type: none"> 6 Food Innovation Hubs are currently in development in India, Colombia, Europe, Vietnam, Kenya and Zambia A Global Coordinating Secretariat is hosted in The Netherlands to catalyze, support and scale the portfolio and to coordinate and share learnings across the emerging network of Food Innovation Hubs The Hubs will leverage technology and broader innovations to strengthen a local innovation ecosystem. All hubs are country-led, multistakeholder, pre-competitive and neutral partnerships focused on scaling and adopting of market-based solutions.
Benefits	<p>Access to capital The Hult Prize is an annual, year-long competition that crowd-sources ideas from students and awards US \$1 million in seed funding to the global winner with a focus on food for good.</p> <p>Technical Assistance 6 local innovations are selected to attend the bootcamp and pitch event. This is a week-long programme, where selected entrepreneurs will work with global experts to (among others) refine their growth strategies, value proposition as well as operating and business model</p>	<p>Digital Inclusion Improving access to technology for farmers, especially women, through the local innovations that are supported</p> <p>Circular Food Systems Innovation Developing end to end value chain from farm to fork by using maximum possible innovation opportunities to drive large scale progress on Future 50 Foods ingredients for brands increase and some have seen loyalty rates increase by 25%-to 60%.</p>

Source: WFP, [Innovation Accelerator Annual Report](#), 2020; WFP, [Innovation Hub for Eastern Africa](#), 2021; WEF, Food Innovation Hub – Strengthening Local Innovation Ecosystems for Food Systems Transformation (Innovation with a Purpose), 2021

Spotlight: Food Waste Management

	Wasteless (Europe)	Algramo (Chile)
Overview	<ul style="list-style-type: none"> 85% of retail food waste is caused by the disposal of products that have gone past their expiration date. Food waste is the estimated cause of 8% of global greenhouse gas emissions. Wasteless uses AI to continuously adjust prices throughout the day depending on sales and 42 other parameters including expiry date, current date and time, costs, inventory, promotions, special events, competitors and complementary items. The company's machine learning technology can be integrated into point-of-sale, inventory systems and electronic price tags used by retailers. Markdowns incentivise consumers to buy products close to their "best-before" date, reducing overall waste and increasing retailers' revenues. 	<ul style="list-style-type: none"> 40% of plastic in the world is used for packaging, often with a use phase of hours and a lifespan of hundreds of years. In Chile, impoverished consumers are forced to buy smaller products which can add 30-50% more to the cost on a per-unit basis, due to the high cost of packaging. Algramo co-develops smart reusable packaging distribution systems into their platform technology so global FMCG brands can reduce packaging waste and minimize product costs. Consumers receive product refills 'by the gram' in convenient locations, either via vending machines or electric tricycle delivery. The platform links radio-frequency identification (RFID) tagged reusable containers with internet of things (IoT) dispensers, allowing consumers to access products at the lowest price point.
Benefits	<p>Waste reduced by 32.7% overall in a pilot with a Spanish retailer.</p> <p>Revenues were boosted by 6.3% in the Madrid trial, with Wasteless estimating retailers' net margins will increase by 3%.</p> <p>Consumers' desire to shop more sustainably is being met, along with fair pricing that reflects the likelihood of products going to waste.</p>	<p>Cost of Unilever's laundry detergent 30% lower than in store.</p> <p>Margins for brands increase and some have seen loyalty rates increase by 25%-to 60%.</p> <p>Scaling Algramo's distribution system, with many products and in many markets, has potential to catalyse reusable packaging systems on a globally significant scale.</p>

Sources: [Wasteless](#); EIT Food, ['Wasteless'](#); World Economic Forum, ['Waste less, sell more - how one startup is using AI to transform food retail'](#); Ubuntu Solutions, [Algramo](#); World Economic Forum, [Contribution: Algramo](#).

Secondary Use Cases

There are other leading innovations across the food value chain that offer insight into models that could transform food systems

Agricultural Production			
Company Name	Link to reference model	Description	Country
Carbon Trust	Sustainability Data Climate smart digital advisory services	Consultancy that helps food businesses measure, manage and reduce their footprint, including a cloud-based reporting system, carbon foot printing software and sustainability data analytics	Global
Cool Farm Tool	Sustainability Data Climate smart digital advisory services	An online greenhouse gas, water and biodiversity calculator which is free to use for individual farmers that want to identify hotspots and test alternative management scenarios.	Global
IBM Food Trust	Supply Chain Data	A blockchain platform providing supply chain data and transparency for a wide range of food industry partners globally	Global
Kalgudi	Farming-as-a-Service (Faas)	Digital agri-convergence platform that services ecosystem stakeholders through its information and advisory services, inputs and outputs marketplaces, and consumer store	India
Kenya Agricultural Livestock Research Organization (KALRO)	Agricultural Data	Corporate body formed by the Kenyan Government to coordinate agricultural research in Kenya. Created the Food Balance Sheet as part of its strategy to become the central data hub for Kenya's agricultural information	Kenya
Margarita	Smart farming with satellite/sensor data	A network providing small dairy farmers with sensors to monitor cows' rumination and movements. AI and data analytics is used to make recommendations to improve animal welfare and productivity.	Mexico
M-shamba	Farming-as-a-Service (FaaS)	Interactive mobile phone platform that provides up to date information to farmers, helps farmers efficiently manage their farms, and connects farmers and traders to potential markets	Kenya
TruTrade	Digital financial services	Mobile commerce solution for rural Africa that combines mobile technology and last mile agent networks to connect agri-input suppliers, financial service providers and commodity buyers to smallholder farmers	Kenya

There are other leading innovations across the food value chain that offer insight into models that could transform food systems

Food manufacturing			
Company Name	Link to reference model	Description	Country
IBM Food Trust	Supply Chain Data	A blockchain platform providing supply chain data and transparency for a wide range of food industry partners globally.	Global
Le Marque du Consomateur	Consumer-led food product design	An initiative allowing consumers to lead the design of food products, which they can then purchase through the online platform.	France

There are other leading innovations across the food value chain that offer insight into models that could transform food systems

Access to market			
Company Name	Link to reference model	Description	Country
BioFerias Agroecológicas	Hyper-local connect	Network of healthy food markets that buy from local producers and distribute to retailers and consumers	Peru
Consumo lo que produzco	Digital Collective Buying	A digital platform set up by CDC (a Consumers International member organization), with government support, to allow consumers to buy directly from small- and medium-scale producers.	El Salvador
Feiras Organicas	Digital food marketplace	Search tool set up by IDEC (a Consumers International member organization) to connect consumers with opportunities to buy organic food direct from producers	Brazil
M-shamba	Hyper-local Connect	Interactive mobile phone platform that provides up to date information to farmers, helps farmers efficiently their farms, and connects farmers and traders to potential markets	Kenya
MGP Distribution	Digital Collective Buying	A scheme run by Consumers International a member that leverages digital to facilitate the purchasing and delivery of food to 2,500 of local buying groups.	India
MUCHO	Digital food marketplace	Ethical consumption platform/app that lets restaurants and individual consumers buy direct from producers. Also seeks to promote better understanding of the food production process	Colombia
Ninjacart	Digital food marketplace	Fresh produce supply chain company which connects food producers directly with retailers, restaurants, and service providers using in-house applications that drive end to end operations	India
TruTrade	Digital food marketplace	Mobile commerce solution for rural Africa that combines mobile technology and last mile agent networks to connect agri-input suppliers, financial service providers and commodity buyers to smallholder farmers	Kenya
Unión de Trabajadores de la Tierra	Digital collective buying	Producers' union that have set up a system for collective/community purchasing of produce	Argentina

There are other leading innovations across the food value chain that offer insight into models that could transform food systems

Food consumption			
Company Name	Link to reference model	Description	Country
ComoQuiero	Consumption planning apps	Meal planning app that allows consumers to build a healthy and balanced menu, and delivers the ingredients directly	Chile
Evocco	Gamification of sustainability purchasing ; Digital consumer information tools	A mobile app that uses allows consumers to trace the carbon footprint of their food shopping, while collecting data to incentivize changes earlier in the value chain	UK, Ireland

Glossary of Terms

Digital Innovations

Term	Description
Macro Crop Planning @ National & State levels	Leveraging AI and remote sensing in providing advisories on sowing windows, analysing sowing areas, tracking sowing progress, providing advisories on crop varieties.
Farming-as-a-Service (FaaS)	Access to technology and data on a subscription or pay-per-use basis, including farm management solutions, production assistance, and access to markets, in order to boost productivity and efficiency.
Smart farming with satellite/sensor data	Use of sensors, satellites, and other farm assets to generate and transmit data about a specific crop, animal or practice in order to optimise production processes and growth conditions while minimising costs and saving resources.
Digital Sharing Platforms	Digital platforms that enable exchange of resources with farmers, including physical resources and information.
Intelligent Crop Planning	Leveraging technology and data to improve decisions on what crops to grow and ensure that this is done in the right soil at the right time.
Digital Financial Services	Financial services accessed and delivered through digital channels, such as digital payments, savings, credit, and agricultural insurance, which increase financial access and equip smallholder farmers to improve yields and incomes and invest in the longer-term growth of their farms.
Climate smart digital advisory services	Digitally delivered information on topics such as agronomic best practices, pests, and weather, that are beyond generalised best practices but recommendations that sustainably increase productivity, resilience, reduce/remove greenhouse gases, and enhance the achievement of national food security and development goals.
Digital Input Marketplaces	Platforms which sell inputs such as seeds, fertilisers, crop protection chemicals to farmers.

Digital Innovations

Term	Description
Leveraging blockchain for Traceability	Using blockchain to trace crops as they moves through the supply chain, providing buyers with the means to ascertain the veracity of specific “single origin” varieties of produce, or trace back the origin of produce in the event of food-safety risk events, or make assertions about following sustainable production and sourcing practices.
Quality control	Measures to ensure that food meets standards of quality, safety, and nutritional value.
eWarehousing	Enhancement of warehousing processes and facilities using IoT and AI enabled systems, e.g., Solar-powered on-farm cold room with IoT, Warehouse management SaaS, and Blockchain-powered warehouse receipt financing.
Hyper-local Connect (Farmer 2 Consumer)	Hyperlocal retail platforms facilitating direct sales between farmers and consumers.
Digital Food Marketplaces	Digital marketplaces that connect smallholder farmers to potential buyers.
Digital collective buying	Purchasing of products and services on digital platforms at significantly lower prices when purchasing as a group.
Smart Logistics (Domestic & Export markets)	Effective use of data and software through automating scheduling, routing, dispatching and billing based upon trip requests, customer locations and vehicle availability, to optimise distribution of goods to consumers.
Demand prediction	Technology and data driven approach to accurately determine consumer demand and reduce wastage.
AI-generated dynamic pricing	Using AI to optimize pricing and incentivize consumers to purchase products that would otherwise go to waste.

Digital Innovations

Term	Description
Consumption planning apps	Mobile apps helping consumers eat healthily and sustainably through personalised meal plans, grocery lists and purchase records.
Gamification of sustainability purchasing	Tools and applications which incentivise sustainable shopping through rewards and the creation of positive habit loops.
Smart food inventory appliances	IoT appliances such as fridges and storage cameras, which provide consumers with a real-time food inventory, help with food organisations and provide alerts of food recalls.
Data driven consumer feedback loops	Data-driven approach to capturing feedback data from consumers to feed into product design.
AI generated recipes	Using Artificial Intelligence to generate cooking recipes which substitute meat for alternatives.
IoT for waste reduction	Smart food containers, smart cameras and smart fridges which monitor food freshness, allowing consumers to minimise waste.
Smart bins	Smart bins which automate waste classification and collect real-time fill level data to streamline waste collection.
Data matching portions with consumption data	Services such as takeout platforms leveraging the growth in consumer food consumption and waste data to match portion size with consumer needs.
Redistribution of unwanted food	Digital platforms enabling restaurants, bakeries, canteens and other suppliers to sell their surplus food to nearby consumers.

End of Full Report