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Data-Driven Food Systems
for Crisis Resiliency

WHITE PAPER

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> Given the fragmented nature of the agriculture sector, ensuring efficient, trusted and human-centric data capture is critical to enable the potential of the sector. Data can help us develop more agile and appropriate wraparound support services to help farmers, at all levels, make more informed decisions and promote equitable financial inclusion and risk management throughout the food value chain.

Leesa Schrader, Director, AgriFin Accelerate Program, Mercy Corps, Kenya

> Unlocking data is critical to increasing access to and reducing the cost of capital to African farmers and unlocking the power of SMEs in agri-food value chains to drive growth on the continent. Currently, different organizations hold different pieces of data, creating cost distortion and inefficiency in the system. If we are to de-risk finance and better serve those most in need of finance, we need to promote an aligned and trusted multistakeholder approach to the collating of data, giving us a 360-degree view of the farmer.

Lauren Hendricks, Chief Executive Officer, Equity Group Foundation, Kenya

> Through an integrated data ecosystem, we have an opportunity to link services directly to the pain points farmers are experiencing, enabling much more targeted and effective nationwide support.

Phillip Thigo, Senior Adviser, Data, Innovation and Open Government, Office of the Deputy President of Kenya

> COVID-19 has highlighted the need to take bold collective action in developing common robust and easy to use mobile-enabled communications platforms that can provide hundreds of millions of users with trusted and relevant data and information. At the same time, these platforms, through data collection and aggregation, can provide public and private institutions with better analysis on key challenges, allowing them to implement appropriate responses. The Africa Communication and Information Platform (ACIP) aims to do exactly that.

Tunde Fafunwa, Lead Adviser, Digital Centre for Excellence, United Nations Economic Commission for Africa (UNECA), Addis Ababa

> Farmers need data from across the value chain to enable them to make better decisions, as much as value chain players need data from farmers. There seems to be a common notion that farmers should provide data in return for services, but the two-way flow of data and value is also crucial, and farmers should equally be receiving data and value back in return.

Ishmael Sunga, Chief Executive Officer, Southern African Confederation of Agricultural Unions (SACAU), South Africa

" The multistakeholder approach is exemplary of the saying 'if you want to go fast go alone, if you want to go far go together'. If we are going to build sustainable long-term solutions to today's challenges, it is important tackle issues together and build consensus.

Simone Sala, Senior Advisor on ICT4D, International Fund for Agricultural Development (IFAD), Rome

" We cannot inform evidence-based decisions to articulate our people's needs without relevant data and information that is accessible and well managed, so platforms designed around the principles we have been discussing are crucial in developing capacity in this space. In the long term, such platforms will pave the way for the digitization of the African food supply chain.

Assia Meghfour, Project Officer, AUDA-NEPAD Planning and Coordinating Agency, Johannesburg

" Having a digital ecosystem that not only gathers data from farmers but also aligns a real-world response to the challenges they are facing, linking farmers to stakeholders from finance, government, civil society who have the interest and capacity to align their response to farmers' challenges and needs, is key to creating a resilient food system in Africa.

Simon Winter, Executive Director, Syngenta Foundation for Sustainable Agriculture, Switzerland

" Reaching the last mile and providing farmers in Africa with the services they need has been a long-term challenge. Overcoming this at the scale necessary can only be achieved by developing shared data aggregation points that combine the efforts of multiple stakeholders working in alignment in a way that is inclusive, trustworthy and, importantly, farmer-centric.

Ruan Boezaart, Head of Smallholder Market Solutions, Digital Farming, Yara International, Norway

" Integrating existing platforms and technologies as part of the solution is imperative to building a data-driven digital ecosystem that will bring value to farmers at scale. We need to meet stakeholders where they are today in terms of technology adoption to ensure we are creating a more inclusive data-centric approach across the value chain.

Katie Hoard, Global Director of Agricultural Innovation & Sustainability, Anheuser-Busch InBev, USA

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Foreword

This report seeks to advance the actionable understanding on an emerging set of approaches for data-driven food systems.

Ibrahim Assane Mayaki
Chief Executive Officer, AUDA-NEPAD Planning and Coordinating Agency, Johannesburg

Lisa Sweet
Head of Future of Protein, COVID Response, and Food-Health, World Economic Forum

Derek O'Halloran
Member of the Executive Committee and Head of Shaping the Future of Digital Economy and New Value Creation, World Economic Forum

COVID-19 has rapidly brought to light the complexities of food systems and the challenges – even in the best of times – to nutritiously, sustainably and inclusively feed the world.

The first half of 2020 has been marked with food market and agri-dealer closures, trade blockages, labour shortages, manufacturing and processing plant closures, shortages of certain food products as buying patterns shifted and bulk buyers such as restaurants or canteens faced closures, and other logistical and tactical issues.

As the pandemic has progressed and implications have expanded beyond the immediate healthcare needs to the broader societal, economic and knock-on implications of this crisis, global, regional and local food systems have begun to face immense pressures that threaten to undermine nutrition at a mass scale and provoke food shortages as primary food production is implicated. COVID-19 has also laid bare the food system's underlying injustices and inequities. For instance, on the Africa continent alone more than 250 million people do not have access to nutritious foods at all, or on a sustainable basis, and with schools closed across the continent millions more children now have no access to the free meals that were the only source of a balanced diet to many.

However, the crisis has brought widespread awareness of tools that are currently underutilized by the food and agriculture sectors, and which – if leveraged intentionally and inclusively – can have a seismic impact on the food system's ability to respond and rebound in times of crisis.

One such tool is data.

This report seeks to advance the actionable understanding on an emerging set of approaches for data-driven food systems across stakeholders, also recognizing the role of community-level public

and private sector players. It explores opportunities for data to enable better decision-making, advance business, product and partnership models, and empower stakeholders across the value chain. It highlights examples showcasing these models in practice. And it recognizes that for our food systems to be better prepared and more resilient in the future, we will need to promote a culture of data that allows for success and scale, and which is supported by key enablers, including policy, capacity building, infrastructure and connectivity, and mobilizing leadership.

This report forms part of a series of outcomes stemming from the COVID Action for Food Systems – Africa multistakeholder efforts launched by the African Union Development Agency (AUDA-NEPAD) in collaboration with the International Fund for Agricultural Development (IFAD) and the World Economic Forum. It was developed as an output of the Data and Information Platforms working group, with input from working group members.

Drafting of the report was led by the World Economic Forum. The working group has been supported by the team from Synergy Global Consulting: Paul Kapelus, Yumna Martin and Brooke Parkin. We are also grateful to members of the Business of Data community, including Francisco D'Souza, Co-Founder, Cognizant and Fellow, World Economic Forum; Sean Wiid, Chief Executive Officer, UP42; Ganesh Venkatesh, Head of Marketing, UP42; and Monika Glowacki, World Economic Forum, for their review and contributions.

Executive Summary

The current crisis provides an opportunity to strategically rethink and retool the food systems to enable data-driven transformation.

For many, 2020 began with a widespread recognition that food systems would require radical transformation if they are to feed a population of 9.8 billion in a manner that is sustainable, inclusive, efficient and nutritious. As we enter into late 2020, months into the reality of the global COVID-19 pandemic, this recognition has been further illuminated as we have seen hunger rise, food logistics crippled, markets and restaurants closed, perishable food destroyed, trade and labour barriers installed, and incomes vanish from direct and indirect COVID-19 actions.

Actions taken to protect and restore food security as the crisis persists, and once recovery begins, will not only have to be significant, they will have to be smarter. They will need to bring a range of actors together with refined incentives to build the food systems back to a stronger, more resilient place that will be able to withstand not only the crisis of today, but those predicted in the future.

In this unprecedented time, enabling and expanding data-driven food systems offers an unparalleled approach to building back stronger, more resilient, more informed, inclusive and equitable systems for the future.

Data-driven food systems – empowered by digital connectivity – is not a new concept; however, the COVID-19 crisis has underscored the necessity of this approach and the urgent need to bring significant resources to bear as a central enabler for the food systems of tomorrow. The current crisis provides an opportunity to strategically rethink and retool the food systems to enable widespread digitalization and data-driven transformation along the agricultural value chain and beyond, resulting in a more integrated approach to uniquely identify long-term solutions that benefit the rural and economic development of entire countries.

By utilizing these emerging data-driven solutions for food and agriculture and viewing them as part of a wider economic enabling framework, partnerships can be leveraged and scaled. Data from across satellite and geospatial operators, ICT and telecommunications providers, e-commerce and logistics companies, and finance providers could all be brought to bear, alongside data from other actors who intersect the food space, such as the mining sector's land utilization patterns. These corresponding data sets, brought together in a joint ecosystem that informs the wider economic and societal development, can thereby create a much greater transformational effect.

This paper, prepared by the World Economic Forum's COVID Action for Food Systems – Africa: Data and Information Platforms Working Group, is intended as a starting point to advance actionable understanding on an emerging set of approaches for data-driven food systems across stakeholders. The intent is for this paper to further inform stakeholders in the food systems and beyond as a stepping stone to the above-mentioned widespread transformational effect for economics and societies. It represents a contribution to an ongoing set of activities across Forum communities, including discussions about the need for greater innovation in food systems and the bodies of work around industry agnostic models for data collaboration.

While the focus is predominantly on Africa given the remit of the working group, concepts are applicable globally and examples are brought in from a range of geographies, including a few from a corresponding ASEAN-focused effort led by the multistakeholder partnership platform, Grow Asia.
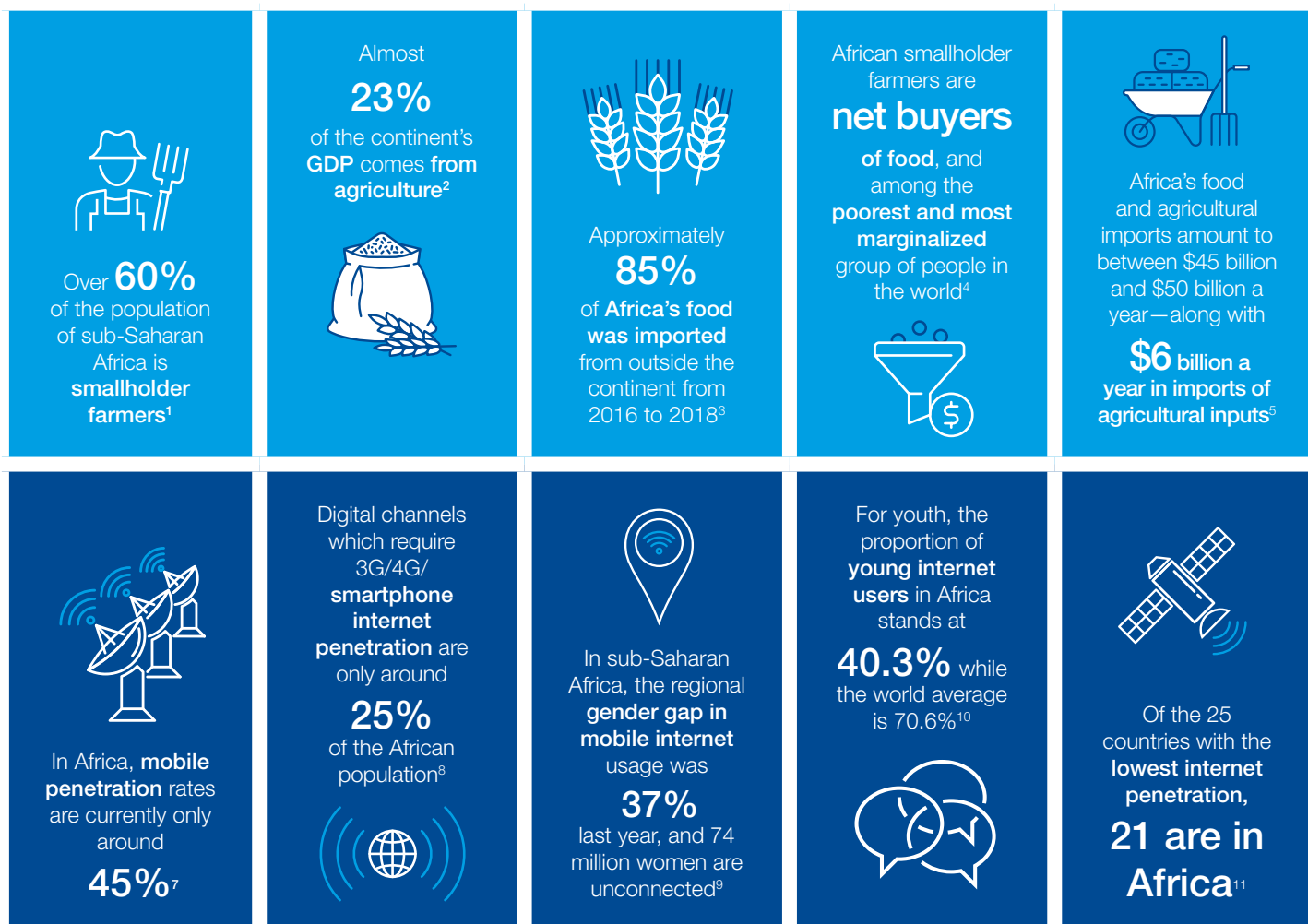
① COVID-19 and Food Systems in Africa

COVID-19 is dramatically accelerating weaknesses in food systems, driving risk of future widespread food insecurity beyond the current immediate logistical roadblocks.

Over **60%** of the population of sub-Saharan Africa is **smallholder farmers**[1]

Almost **23%** of the continent's **GDP** comes **from agriculture**[2]

Approximately **85%** of **Africa's food was imported** from outside the continent from 2016 to 2018[3]

African smallholder farmers are **net buyers** of food, and among the **poorest and most marginalized** group of people in the world[4]

Africa's food and agricultural imports amount to between $45 billion and $50 billion a year—along with **$6** billion a year in imports of **agricultural inputs**[5]

In Africa, **mobile penetration** rates are currently only around **45%**[7]

Digital channels which require 3G/4G/ **smartphone internet penetration** are only around **25%** of the African population[8]

In sub-Saharan Africa, the regional **gender gap in mobile internet** usage was **37%** last year, and 74 million women are unconnected[9]

For youth, the proportion of **young internet users** in Africa stands at **40.3%** while the world average is 70.6%[10]

Of the 25 countries with the **lowest internet penetration, 21 are in Africa**[11]

Anticipated COVID-19 implications to African food systems

As COVID-19 implications have expanded from immediate healthcare needs to the broader societal, economic and knock-on implications of this crisis, the resiliency and inefficiencies of global, regional and local food systems has become increasingly apparent for the African continent.

In Africa, food and corresponding agriculture systems play a central role in livelihoods and economics, and the continent is highly exposed in times of international crisis given its dependency on trans-border food imports.

While food insecurity across the continent was widespread before COVID-19, the challenges presented to the food systems by the pandemic – from market closures and trade blockages, to labour and income shortages – are primed to be particularly acute. Additionally, for many, COVID-19 is adding to the already desperate circumstances smallholder farmers are already faced with, further amplifying their predicament. COVID-19 is predicted to have the potential to spark a food security crisis in Africa, with agricultural production potentially contracting between 2.6% to 7%.[12] The expected contraction will cause a decline in Africa's agricultural exports, putting livelihoods and jobs at risk.[13] Furthermore, food imports could decline substantially, from up to 13% to 25%, due to higher transaction costs and reduced domestic demand from the crisis,[14] further exacerbating the crisis.

According to the World Food Programme (WFP), an additional 20 million people could struggle to feed themselves due to the socio-economic impact of COVID-19 in the coming months, which will double the total number of people facing desperate food shortage in sub-Saharan Africa to over 40 million.[15] As health, food security and poverty impacts intertwine, they will tend to impact women and youth disproportionately.

At a holistic level, one can see clear patterns of COVID-19 implications on the food systems in Africa. However, the data is not always sufficient, speedy or specific enough to understand the nuanced picture to enable the strategically targeted interventions most needed to protect the African food systems throughout this crisis and beyond.

In April 2020, the African Union Development Agency (AUDA-NEPAD), International Fund for Agricultural Development (IFAD) and World Economic Forum virtually convened 80 global and continental leaders across government, business, farmers associations, civil society, international organizations and innovators to discuss actions needed in response to COVID-19, recognizing as well that the crisis has provided a window of opportunity to accelerate corrective actions. The leaders overwhelmingly called for joint action in support of unlocking reliable and timely data upon which they could base their decisions and actions.

Food imports could decline substantially, from up to 13% to 25%

Additional 20 million people could struggle to feed themselves

(2) # A Digital and Data Revolution for Enhanced Food System Resiliency

The new normal will need to leverage digital and data by default.

According to AUDA-NEPAD, COVID-19 is the most important factor driving structural shifts and policy in food production market systems in Africa. Impacts will be long term and varied. Much as the effects of the 2007-2008 global financial crisis reverberated over a time horizon of at least a decade, the "new normal" and "reimagined" context for markets, budgets and policy choices from COVID-19 can be expected to last until at least 2030.

The COVID-19 pandemic has brought the unique opportunity to be the necessary watershed moment for recognition and alignment around a transformation that is informed by data, to support agriculture and resiliency of food systems in times of crisis. Used with wisdom, a granular data-driven understanding of communities and individuals, of complex natural ecosystems, of value chains can open new possibilities for well-being and deliver unimaginable benefits.[16] While the timeline for African food systems to "bounce back" once a vaccine is widely available is unknown, stakeholders should prepare to bounce back smartly by leveraging data.

In this regard, it is key for stakeholders to recognize that the use of data has now evolved from old, linear models with a focus on increased efficiency and better post-hoc decision-making. New models are highlighting ways to use data to generate top-line value for all actors in the value chain, including farmers. Worldwide, today's use cases frequently draw on data from multiple sources, generate value for multiple entities and embed both end user and partner interests.[17]

By creating data capacity to track and forecast food availability, pricing and accessibility, logistical flows and other factors during and after the crisis, stakeholders across food systems can find wide application and create significant new value pools. Accelerating digitalization throughout the entire food value chain can act as a critical enabler to support bringing together multiple sources of data – from geo-satellite data and ICT, to e-commerce, logistics and finance – and critically to go beyond a mindset of thinking of farmers solely as beneficiaries of data. Rather, the famers become actors in data systems in their own right, owning and monetizing the value of their data, and leveraging pools of actionable information that the data can bring to them to create more resiliency for not only their crops, but also their livelihoods.

Three archetypes are emerging to leverage data through an ecosystem approach, which empowers value creation across stakeholders, for enhanced food system resiliency. These include:

FIGURE 1 | **Opportunities for data-driven value creation in food systems**

Archetype	Opportunity	Food resilience application
Better decisions	• Analytics-based insights for better contextualized decision-making • Improvements to operational efficiency within the ecosystem • Enhanced monitoring and evaluation process	• Early warning/early action for rapidly evolving situations • Enabling real-time and precision data on which to apply government, NGO or business support • Applied farming decisions and targeted extension services • Flexible supply chains and logistics, rewired to route food and inputs more dynamically • Repository of shared experience and lessons learned during recurring challenges and crises
Enhanced business, product and partnership models	• New business models, enabled by data insights and analytics • New revenue streams, products and services for a broader range of stakeholders • Combining data sets • Public-private partnerships	• Reach extension (last mile/rural) • User-side (farmer/SME, etc.) application for data and information • De-risking capabilities and tailored finance products through comprehensive risk profiles, credit scoring, insurance models and data clearing houses • Greater efficiency in allocation of public and private resources to support the best opportunities and to target the most vulnerable (e.g. warehousing utilization) • Interoperability and maximized return on investment on applications • Expanded and efficient intra-trade in agricultural and food products
Empowered stakeholders across the value chain	• More meaningful, personalized engagement and experiences • Lower barriers to entry and ongoing usage • Commercial incentives aligned with user protections • Trustworthy interactions and information • Increased transparency and fairness	• Responsive two-way value flow, including continuous improvement on behalf of the user (farmer/SME, etc.) • Privacy and intellectual property protection, safeguards in the system, trusted information (e.g. how to prevent spread of COVID) • Single sign-on (SSO) and digital identity to leverage existing systems and to meet stakeholders where they are

(3) Opportunities

Learnings from early responses and actions undertaken by stakeholders to leverage these new data-driven models.

Business, government, civil society organizations, innovators and others are already beginning to showcase the three archetypes which leverage data in practice, to enhance food systems resiliency, in Africa and elsewhere. Many African farmers, and the associations that represent them, have yet to leverage these new models. However, impactful examples are beginning to emerge across all stakeholders. Highlighted below are some of these examples, mainly pulling from Africa given the remit of the working group, with a few coming from Asia. While the examples have been assigned to a particular archetype, many cut across all three.

Better decisions

By 2025, 49% of the world's data will be in public cloud environments; nearly 30% will be real time, allowing for faster and contextualized decision-making.[18] Analytics-based insights from available data is already helping organizations, governments and businesses to make better decisions in areas ranging from resource allocation and business process optimization, to supply chain management, hotspot identification, specialized extension services and more.

Accelerate digital and data readiness at the national level

The Ministry of Agriculture, Livestock and Fisheries of Kenya, in conjunction with local government and development partners, established the Food Security War Room in a bid to alleviate risks associated with food insecurity and ensure informed decision-making during response and recovery of COVID-19. The war room, coordinated by the Agriculture Transformation Office (ATO), acts as a "nerve centre", with representatives from the Council of Governors, different relevant ministries and the private sector. The Food Security War Room deploys digital tools and data-gathering approaches to collect real-time data on food availability, accessibility and affordability. By centralizing technology and data, the government can see across ministries, counties and issue areas, such as pricing and availability of staple foods, and produces clear dashboards on trends to identify any hotspots for government, NGO or business support.

Understanding farmer constraints in a rapidly evolving context

The impacts of COVID-19 have created incremental uncertainty on top of the often particularly uncertain circumstances of smallholder farmers. Given many farmers face limited connectivity, assessing the range and scale of their constraints is a challenge. Since its inception, Precision Agriculture for Development (PAD) has reached 3.58 million farmers across eight countries, offering high-quality information and extension services intended to increase their productivity, profitability and environmental sustainability. PAD supports a two-way flow of information whereby farmers share accurate information that allows PAD to tailor its content and services, creating a cycle of continual improvement. From April to June 2020, PAD interviewed 973 crop farmers and 483 agro-dealers registered to the MoA-INFO SMS platform in Kenya.[19] Most farmers reported financial distress and food shortages. The agro-dealers who participated in the survey reported closing shops earlier, lower foot traffic and revenues. As a follow up, PAD and IFAD launched a partnership under IFAD's Rural Poor Stimulus Facility (RPSF) to provide some 1.7 million small-scale farmers in Kenya, Nigeria and Pakistan with personalized agricultural advice through their mobile phones as part of its strategy to improve the resilience of rural livelihoods in the context of the crisis by ensuring timely access to inputs, information, markets and liquidity.

Cross-sector collaboration to improve logistics in ASEAN

COVID-19 has caused local and worldwide disruptions to trade and food supply. Restrictions to the movement of people has frozen critical labour, and restrictions to the movement of goods and closed transport channels led to waste of seeds and produce. To help leaders from the public and private sector align and collaborate to make better decisions, Grow Asia, IFAD and the World Economic Forum created a working group of agribusinesses, agricultural ministries, logistics companies, development agencies, fund managers and legal service providers in ASEAN. The group is focused on improving rural logistics with technology and data to create greater efficiency in first-mile logistics: the weakest link with the highest unit cost in the supply chain. To increase the flow of goods, the group has consolidated best global practices on the operation of green/food lanes and protection of the health of the workers. The group is also planning a challenge fund to develop digital applications to illuminate the data, enabling the consolidation of food consignments from multiple farmers, which can then be put out for competitive bidding from local truckers and passing empty backhauls.

Enhanced business and partnership models

New, collaborative business and partnership models are addressing users' core needs and building trust while enabling new business opportunities. The models allow organizations to augment individual data sets with external data, creating ecosystems for new opportunities and delivering a broader range of products and services, embedding privacy, security and agency.[20]

Digitizing value chains to connect farmers to service ecosystems and create economic passports

Smallholder famers often lack formal records of their economic history, preventing them from accessing the financial services, such as credit or insurance, that they need to be able grow and withstand crises like COVID-19. In Zambia, BanQu, AB InBev and Zanaco are working to digitize the supply chain. AB InBev leverages BanQu, a blockchain-enabled software service provider that records physical and monetary assets, to record the transaction history between itself and farmers, with financial transactions and mobile money payments currently supported by Airtel, MTN and Zanaco's AgriPay solution (BanQu is interoperable and provider agnostic). Doing so builds up a digital economic passport for the farmer so that they can choose to share that data with other service providers to demonstrate their credit history and worthiness. With such a passport, farmers can grow their businesses sustainably and withstand shocks by accessing the products and services they need to support their livelihoods and continue producing to support the food system.

Integrating public data with mass messaging to engage citizens across Africa

Capturing data on rural communities where connectivity is poor can be expensive and time-consuming. With COVID-19 there has been the additional challenge of engaging citizens to communicate health advice and combat misinformation. This has demonstrated the need for an effective method for information and communication that reaches the majority of the population, with corresponding analytics to understand the risk factors and design corresponding policy. To address the urgent need for data and information UNECA, Africa CDC and partners developed the African COVID-19 Communications and Information Platform (ACIP). ACIP integrates public data from digital channels and online sources such as social media, with mobile narrowband information gathering via short codes (*xxx#) and interactive voice response, making it accessible to everyone with a phone. This unique approach has tremendous scale potential as it combines the depth of online digital information, which reaches 23% of Africans, with the extensive reach of mobile, which touches more than 300 million people.

Mobile money to keep SMEs afloat and citizens safe in Cambodia

Blockages to rural cash flow are a major problem for South-East Asia's food systems. In an economy that is becoming less cash based, rural SMEs and producers – most of whom are unbanked – risk becoming increasingly marginalized. Mobile money provides a solution, enabling payments to be sent digitally and allowing these payments to be readily converted into cash by a network of local agents. Over the past 12 years in Cambodia, Wing Money has already provided fast, dependable and affordable digital and cashless financial solutions to the unbanked and underbanked. This has opened opportunities for them to participate in Cambodia's economic development. Wing's innovative products, such as QR payments, online Mastercards and NFC payments proved to be even more essential when the physical restraints of COVID-19 hit, in allowing SMEs and farmers to carry on making transactions and operating. While mobile money has faced resistance in the past for inclusivity, the COVID effect has shown how its benefits can also be especially vital to the most economically disadvantaged.

Role of partnerships in building digital data platforms for smallholders

For partnerships to work, organizations must recognize that no single company has expertise in all areas, and that different partners bring unique value to a product/service and to the end consumer. Mercy Corps AgriFin's COVID-19 response has hinged on this, bringing together a consortium of partners to leverage data to better understand the needs of farmers during this time and enhance and strengthen response offerings using trusted digital channels at scale. AgriFin's partners are reaching 8 million smallholder farmers across Kenya, Ethiopia and Nigeria through: ideo.org content with WeFarm/Producers Direct; linking the ecosystem on the finance side with agro-dealer networks; weekly TV programming and call centre support targeting farming communities; IVR support to answer detailed questions; and integrated desert locust and COVID-19 response efforts via digital citizen reporting tools to support simultaneous crises in farming areas.

Empowered stakeholders across the value chain

Businesses, innovators, governments and NGOs are increasingly coming together to form a collaborative and inclusive ecosystem where data can be exchanged and harnessed to create value in a trustworthy way. This includes using data to offer more trusted and bespoke products and services to improve experiences and outcomes for stakeholders across lifecycles and contexts, and to open new opportunities for business and socioeconomic development.

Offering trusted advice to keep Zambia dairy farmers safe

To grow the dairy value chain in Zambia by integrating small-scale producers, the Diary Association of Zambia developed a digital information management system (DIMS) that records producers' transaction history. What makes DIMS unique is that it is a part of the supply chain, integrated into platforms at milk collection centres (MCCs), leveraging the MCCs into business hubs. Outside of acting as a record management and information system, milk producers use the data to track their milk supply to collection centres, and their aggregated data enables them to access services and inputs. COVID-19 has demonstrated the value of having a digital system as it allowed the association to interface with members and respond to their needs in this changed environment. The DIMS platform has an integrated tool that enables sharing of extension, health and safety information with users on the platform. The association also used DIMS to disseminate health information and is putting place social-distancing measures by encouraging the sending of money by mobile money payments systems.

Connecting farmers to consumers and leapfrogging COVID logistical barriers

The path from produce to plate is a complex system often involving multiple actors who add value at different stages. During COVID-19, this complex chain has instead acted as a barrier, with the first-mile connectivity often proving to be the weakest link. Pinduoduo (PDD) is a China-based e-commerce marketing platform that has been leveraging data and technology to develop a group buying approach called "pin". The approach is intended to bring economies of scale to smallholder farmers and value direct to the consumer. As markets closed, marketing channels changed and other protective measures were put in place, consumers increasingly switched to online purchases of food. The "pin" model allowed for farmers to expand – rather than shut – their sales channels. An additional benefit has been the data transfer that has raised the market awareness of the producers to changes in the consumer demand. For instance, identifying that a particular coffee variety is not selling well, or of the opportunity to sell green coffee beans direct to a roaster. This benefits stakeholders at both ends of the value chain.

Empowering stakeholders to create value with democratized access to data

#Africa4Future is a public-private partnership between aerospace company Airbus, its subsidiary UP42, German development agency GIZ, start-up consultancy Co-Creation Hub and NGO Endeva, aiming to accelerate African entrepreneurs tackling problems in agriculture. The initiative provides start-ups in the cohort with easy access to UP42's geospatial data, analytics and infrastructure through its open platform and marketplace. A data-empowered entrepreneurial ecosystem is co-creating high-impact products that will not only provide more value for their customers, but also support sustainable socioeconomic growth. Innovators are developing and deploying a credit scoring model based on historical time-series data of farm performance that will facilitate the provision of finance to smallholder farmers, solutions for pasture management, fertilizer recommendations and yield prediction for smallholder farmers, a national post-harvest supply chain solution that forecasts supply and matches it with demand and logistics services, and a big data analytics dashboard to help farmers, corporates and governments make key agricultural decisions. By collaborating with the private sector and democratizing access to data, this partnership is generating opportunities for stakeholders across the value chain of the agricultural sector and powering downstream innovation.

(4) Scaling for Long-Term Impact

To increase resiliency for COVID-19 and beyond, actors across sectors and stakeholders will need accelerated collaboration and alignment in the use of data for food systems.

Scaling data-driven models, such as those highlighted above, can have a major impact as a backbone of food systems resiliency – not only for COVID-19, but also as the system encounters ongoing and future stressors including climate change, resource scarcity such as water shortages, pest and disease outbreaks such as locust infestations, and other disruptions.

Designing for success

Figure 2 below depicts the illustrative architecture of a data ecosystem to support stakeholders in making resource deployment, knowledge transfer and business decisions based upon reliable and timely data.

Data sharing is complex and sensitive and can be held back by a variety of factors, including privacy concerns, commercial, reputational and regulatory risks, and immature capabilities.[21] To meet the needs of various stakeholders within a data ecosystem, designing with the following factors can support the success of the approach:

1. **Design for value sharing**. Organizations framing the data ecosystem design solely from their own perspective will limit both the opportunities and the effectiveness of data utilization. Designing for *decentralized learning*[22] will power a more vibrant data ecosystem. Clarity on the intended use cases for the data, the incentives for an ecosystem of actors to contribute and co-creation of solutions are critical enablers.

2. **Design for interoperability**. A vibrant, agile, user-centric and open data-driven food system, with data flowing seamlessly between users and the ability to leverage insights from adjacent data sets, will rely on numerous stakeholders contributing to the ecosystem of resources intended to reach farmers, SMEs and others throughout the value chains. For instance, a farmer may wish for a package of resources, from finance to digital extension services to weather information, without being burdened to reach out to each separately. Furthermore, providing a services ecosystem beyond the farming sphere can support the range of social, economic and other needs of rural inhabitants who otherwise have limited access. Designing for *interoperability*[23] and *distributed insight generation*[24] will power a more vibrant data ecosystem and maximize the return on investment on and the impact of the different applications.

3. **Design for scale**. With over 60% of the population of sub-Saharan Africa being smallholder farmers, many of whom are in rural contexts, a critical threshold of reach will only be achieved if the ecosystems are designed with scale in mind. This can include the need to:

   – Leverage feature phones (rather than solely smart phones) and translation services for local dialects, to increase opportunities for user uptake.

   – Support efforts that encourage unique IDs and farmer registries to increase the rate of user acquisition and lower and centralize costs.

   – Adapt design considerations to support field-based data collection, which will allow for the full value capture on satellite, sensor and other place-based big data sets.

   – Adopt a sub-regional collaborative approach, for instance, leveraging a common approach across the Southern African Development Community (SADC).

4. **Design for inclusivity**. Aligned with the above, designing for inclusivity – for instance, inclusion of women and youth – will enable much greater success in the data ecosystems to support resilience for these communities. Design should address:

   – Connectivity – the connection to sufficient data, for useful services, at the right speed, on adequate devices – must be addressed with even more focused effort and collaboration

   – Reducing inherent bias in data models

   – Ensuring equitable access for end users

   – Lowering barriers to user access by accounting for different forms of input data

5. **Design for innovation ecosystems.**[25] The *innovation ecosystem* is the environment that enables innovators, particularly those in the technology space, to engage in iterative processes with diverse stakeholders, the goal of generating solutions for local challenges and scaling them up. Robust innovation ecosystems can be achieved through policy, investment, capacity building and partnership that enables collective action. An innovation ecosystem should be able to provide support in key areas:

– Encouraging technology and business model innovation

– Scaling ideas in market

– Expanding into multiple markets

– Recognizing users as a critical *source* of innovation – not just user of its benefits

– Building on past ideas and learning from failures through collaboration and incentives

FIGURE 2 | **Illustrative data ecosystem architecture**

COVID Action for Food Systems:
Illustrative architecture
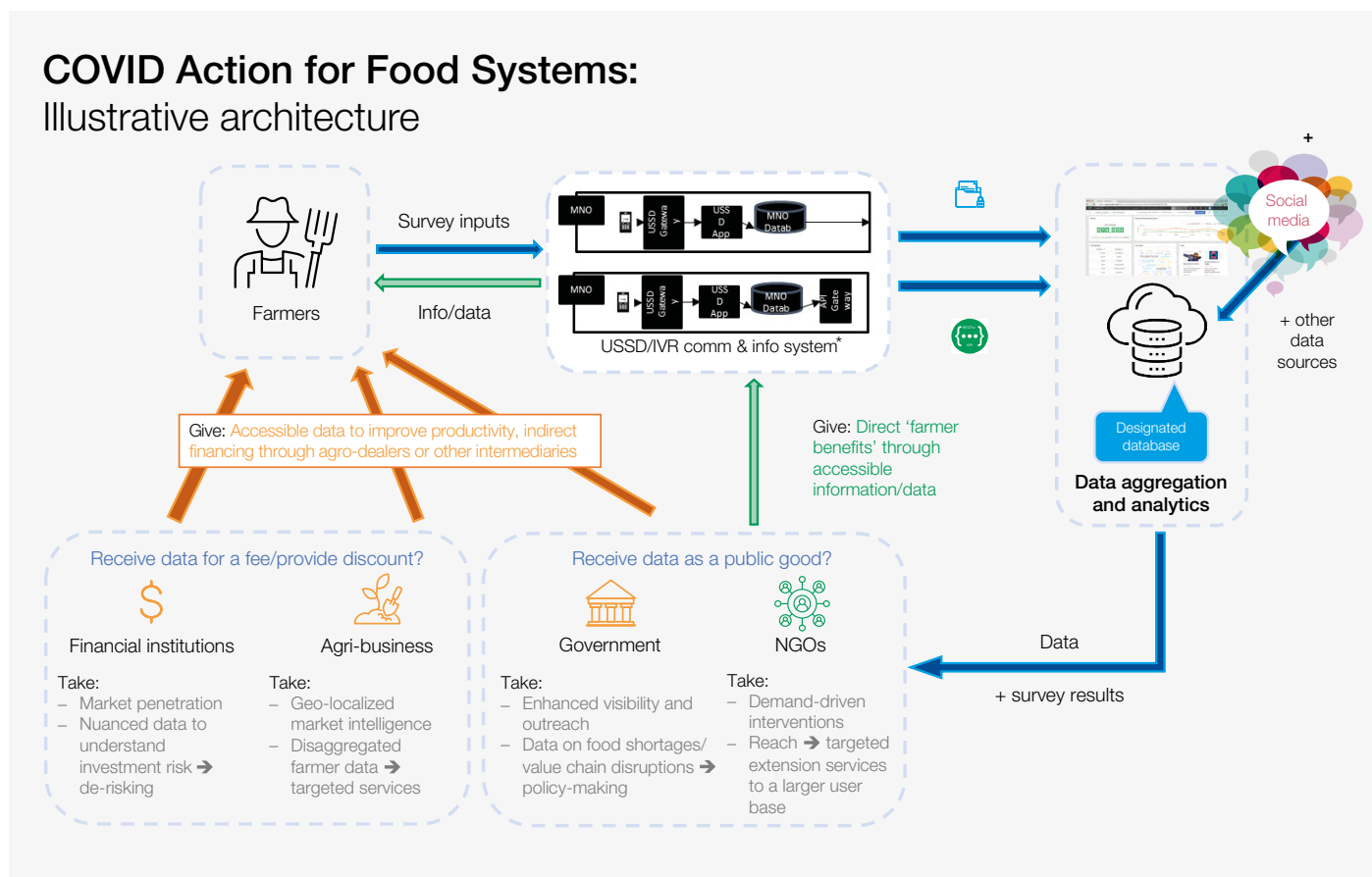
Designed by the working group, the above pictorial represents an illustrative data ecosystem architecture. This was designed around the following use case – at the start of the COVID-19 crisis, there was not a food shortage; the issues were founded around supply chain disruptions and health concerns. As COVID-19 implications compound, there is concern that next season, there will be food production shortages. What data ecosystem can accelerate efforts to stop this from being realized?

Enabling environment

Beyond design, supporting data-driven models will require a vibrant enabling environment, one inclusive of policy, partnership and capacity building, and which mobilizes leadership necessary to empower collective action.

Policy. A whole of government approach can enable a data-driven food system, as the realm sits beyond solely ministries of agriculture. Strengthening food systems for greater resilience will require collaborative policy and regulatory frameworks. Specific calls for action by government that cross ministries include the need to:

– Enhance connectivity for rural areas and interoperability across ICT providers to support inclusion and trusted data flows, supported by unlocking rural ICT access funds.

– Establish and provide farmers with recognized unique digital identities to access government and private services and establish national trusted sources of information flows and farmer databases.

– Provide financial stimulus to encourage a shift to modern communication technology, particularly poor farmers.

– Support ongoing resources for data collection that extend beyond an acute crisis and help build long-term resiliency.

– Design policies in a user-driven and consultative manner such that they respond to the needs of the beneficiaries

Infrastructure and connectivity. A transformative data ecosystem for food will require leveraging and extending digital infrastructure and connectivity, with emphasis on the many who remain unconnected and risk being further left behind. According to the Playbook for Accelerating Digital Inclusion in the New Normal[26] launched in April, recommended actions include the need to:

– Address connectivity – the connection to sufficient data, for useful services, at the right speed, on adequate devices – with focused effort and collaboration.

– Allocate portions of COVID-19 stimulus packages towards the digitization of key industries, and digital infrastructure and connectivity initiatives.

– Prioritize digital transformation of small and medium-sized businesses as key growth drivers of national economies.

– Leverage the power of mobile big data.

Capacity building. Accelerating data readiness, with the digital backbone that underlies the new data opportunities, will require capacity building at the individual, organization and ecosystem levels. Recommended actions to accelerate capacity include the need to:

– Accelerate digital and data readiness at the national level through intentional nerve centres for crisis response, such as the one created in Kenya (see box, "Accelerate digital and data readiness at the national level").

– Provide training, inclusive of digital literacy and technical capacities, and incentives for farmers and farmer organizations, field agents, agro-dealers and other intermediaries interacting with farmers to understand and value data and the resulting information it can provide, so the data-driven food system can be demand led and the farmers themselves become beneficiaries of their own information.

– Improve IVR and video capacity building to reach smallholder farmers with literacy and language barriers.

Mobilizing leadership. COVID-19 has illustrated the fragility of food systems, particularly those among the most vulnerable such as those in Africa. Leaders must act quickly, urgently and collaboratively to set the stage for more resilient, data-driven food systems are put in place. Leaders can be called on to:

– Seek out partnerships across actors and stakeholders: from agriculture to ICT, from farmers to consumers, from business to government to development partners, across value chains, across borders, and beyond. Additionally, leaders can:

  – Share experts from within their organization

  – Commit to co-investing with technical and financial resources to strengthen the ecosystems

  – Commit their organizations to contribute to and use the data, and the lessons learned from doing so

– Act with urgency

Additional Resources

For use cases that leverage technology in the food systems:

– Innovation with a Purpose: The role of technology innovation in accelerating food systems transformation

– Innovation with a Purpose: Improving Traceability in Food Value Chains through Technology Innovations

For a framework for new business paradigm for data:

– A New Paradigm for Business of Data

For guiding principles to establish public-private partnerships for inclusivity:

– Data Collaboration for the Common Good Enabling Trust and Innovation Through Public-Private Partnerships

– Accelerating Digital Inclusion in the New Normal

For design frameworks to operationalize empowerment of end users through good digital identity:

– Reimagining Digital Identity: A Strategic Imperative

Contributors

This report was developed as an output of the COVID Action for Food Systems – Africa: Data and Information Platforms Working Group, with input from working group members. Drafting of the report was led by the World Economic Forum: Lisa Sweet, Head of Future of Protein, COVID Response, and Food-Health for the Food Systems Initiative, and Eniola Mafe, Lead, Internet for All and Digital Inclusion, and with the support of Sean de Cleene, Member of the Executive Committee and Head of the Food Systems Initiative, and Derek O'Halloran, Member of the Executive Committee and Head of Shaping the Future of Digital Economy and New Value Creation.

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Working group members and specialist contributors

Emmanuel Bakirdjian
Africa Regional Director, Precision Agriculture for Development (PAD), USA

Ruan Boezaart
Vice-President, Smallholder Market Solutions, Digital Farming, Yara International, Norway

Martin Bwalya
Head, Centres of Excellence Management and Coordination, AUDA-NEPAD Planning and Coordinating Agency, Johannesburg

Tunde Fafunwa
Lead Adviser, Digital Centre for Excellence, United Nations Economic Commission for Africa (UNECA), Addis Ababa

Mark Geoghegan*
Business Solutions Architect, BanQu, USA

Lauren Hendricks
Chief Executive Officer, Equity Group Foundation International, Kenya

Katie Hoard
Global Director of Agricultural Innovation & Sustainability, AB InBev, USA

Jeremiah Kasalo
Executive Manager, Dairy Association of Zambia (DAZ), Zambia

Mario Kunz
Smallholder Digital Solutions Lead, Syngenta Foundation for Sustainable Agriculture, Switzerland

Bernice Mclean
Senior Programme Officer, AUDA-NEPAD Planning and Coordinating Agency, Johannesburg

Assia Meghfour
Project Officer, AUDA-NEPAD Planning and Coordinating Agency, Johannesburg

John Mundy
Country Director, Tanzania, AgriFin and Emergency Response Manager - Covid-19 & Desert Locust, Mercy Corps, USA

George Murumba
Industrialization and Policy Unit, AUDA-NEPAD Planning and Coordinating Agency, Johannesburg

Victor Ngandu
Project Manager, Dairy Association of Zambia (DAZ), Zambia

Kabelo Ngwenya-Kalabamu*
Business Manager, Office of the Chief Executive Officer, MTN Group, South Africa

Charles Nhemachena
Programme Officer, Regional Food Trade & Resilience, Alliance for a Green Revolution in Africa (AGRA), Kenya

Mustafa Sakr
Principal Program Officer, AUDA-NEPAD, AUDA-NEPAD Planning and Coordinating Agency, Johannesburg

Simone Sala
Senior Advisor on ICT4D, International Fund for Agricultural Development (IFAD), Rome

Leesa Shrader
Program Director, AgriFin Accelerate and AgriFin Digital Farmer, Mercy Corps, Kenya

Ishmael Sunga
Chief Executive Officer, Southern African Confederation of Agricultural Unions (SACAU), South Africa

Philip Thigo
Senior Adviser, Data, Innovation and Open Government, Office of the Deputy President of Kenya

Ben Valk
Head, Food and Agri Partnerships, Rabobank, Netherlands

Simon Winter
Executive Director, Syngenta Foundation for Sustainable Agriculture, Switzerland

* Specialist contributor

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22. Decentralized learning uses data distributed across multiple locations to train one shared ML model. Data is processed without ever leaving its original location; only the learnings go to the central model. This technique preserves privacy and makes training possible when the relevant data is not in the same place at the same time, for commercial or other reasons. Source: World Economic Forum, *A New Paradigm for Business of Data*, July 2020, https://www.weforum.org/reports/new-paradigm-for-business-of-data.

23. Data interoperability addresses the ability of systems and services that create, exchange and consume data to have clear, shared expectations for the contents, context and meaning of that data.

24. Like decentralized learning, distributed insight generation accesses and analyses data spread across multiple locations. It relies on moving code and sharing the algorithm that extracts insights from various data sets, rather than moving the data. Source: World Economic Forum, *A New Paradigm for Business of Data*, July 2020, https://www.weforum.org/reports/new-paradigm-for-business-of-data.

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