UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

SMART AGRIBUSINESS

ISSUE PAPER

SUSTAINABLE DEVELOPMENT GOALS

Acknowledgements

This Issue Paper contributes to UNIDO's Strategic Framework of the Fourth Industrial Revolution (4IR) and was prepared under the overall guidance of the UNIDO Directorate of Digitalization and Agri-Business Development. UNIDO's Department of Agri-business was responsible for the organization of a virtual Expert Group Meeting in 28 September 2021, which brought together specialists from different part of the agri-business value chain and represented various private, private and development agencies as we as the academia.

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Furthermore, many individuals and organizations contributed to the preparation of this Issue Paper. UNIDO extends its appreciation to all those who directly contributed through participation in the Expert Group Meetings and to those who provided their feedback on this Issue Paper. UNIDO acknowledges the contribution of the following individuals and organizations: Salma Abbasi – eWorldWide, Lya Ajenjo – UNIDO, Hasib Ashan – IT University of Copenhagen, Ali Badarneh – UNIDO, Stuart Bashford – Bühler Group, Bernardo Calzadilla-Sarmiento - UNIDO, Belen Casanas – UNIDO, Elias Chembe – MTN Liberia, Matteo Cunial – Farm Technologies, Juan Pablo Davila – UNIDO, Davide De Prosperis – UNIDO, Flora Endl – UNIDO, Bruce J. Erickson – Department of Agronomy Purdue University, Guy Faure – European Commission, Brenda Gunde – IFAD, Christo Helm – Topcon, Zvi Herman – Agro Rural consultant , Sophia Huyer - CGIAR, Chakib Jenane – World Bank, Marco Kamiya – UNIDO, Alfred Rol – Ag Leader, Ramdane Orou Sannou – Flores University, Gerard Sylvester – FAO, Dejene Tezera – UNIDO.

UNIDO extends its appreciation to ITU—World Summit on the Information Society for permitting the use of photographs from its annual WSIS Forum Photo Contest in this document.

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GLOSSARY

• **Digital literacy**	Digital literacy refers to an individual's ability to find, evaluate, and clearly communicate information through typing and other media on various digital platforms.
• **Digital transformation**	Digital transformation is business transformation enabled by digitalization.
• **Digitalization**	Digitalization refers to enabling or improving processes by leveraging digital technologies and digitized data. Therefore, digitalization presumes digitization.
• **Digitization**	Digitization is the process of converting data/information that is non-digital into a digital representation or artefact.
• **Fourth Industrial Revolution (4IR)**	"Fourth Industrial Revolution" refers to the ongoing Industrial revolution that focuses on creating a connected ecosystem by focusing on interconnectivity, on automation, on the Internet-of-Things, on Artificial Intelligence/ machine learning, on big data and on other digital technologies.
• **Industrializing countries (ICs)**	Countries that have not achieved a significant degree of industrialization relative to their populations, and have, in most cases, a medium to low standard of living. For this paper, countries that come under the Least Developed Countries (LDCs) and Middle Income Countries (MICs) categories are grouped under ICs.
• **Internet of things (IoT)**	System in which devices (including mobile phones, sensors, drones, and satellites) are connected to the internet.
• **Non-food agriculture products**	Products that are an output of agricultural activity, not used for human and animal consumption (such as leather, textiles, bio-fuels).
• **Off-farm**	Off-farm income encompasses all agriculture-related activities that occur beyond the farm. Viewed through a value chain lens, off-farm income includes the “middle” and “end” of the process, as agricultural inputs arrive at the farm and goods leave the farm to ultimately reach the consumer.
• **On-farm**	On-farm activities consist of farming and agricultural production, including casual and seasonal labour. Viewed through a value chain lens, on-farm work occurs at the “beginning” of the value chain.
• **Precision Agriculture**	Technologies that are employed for precision farming; including global positioning system (GPS) guidance systems, GPS yield and soil monitors/maps, and variable-rate input application technologies (VRT), etc, with the aim of improving crop production.
• **Smart Agribusiness**	Smart Agribusiness refers to applications of digital technologies to improve efficiency of all the stakeholders in the interrelated and inter-dependent value chains in agriculture.

ABOUT THIS PUBLICATION

The agriculture sector is facing multiple challenges across the world. With the global population projected to increase significantly in the future, from 7.6 billion in 2018 to 9.6 billion in 2050, combined to the shrinking of essential natural resources (such as water and crop land) and the effects of climate change, there is a need for a new revolution in agriculture and the food sector.[1] Smart Agribusiness has been viewed as having the potential to provide this much-needed revolution.

The goal of Smart Agribusiness is to leverage the recent surge in technologies (such as blockchain, internet of things, artificial intelligence, remote sensing technologies, cloud computing and mobile internet) to reduce information and financial asymmetry across the agricultural value chain. Through the use of these technologies, Smart Agribusiness can increase farmer's access to inputs, information, finance and knowledge. This is especially true for the 500 million smallholder farming households globally, who also comprise a large proportion of the world's poor.

The aim of this publication is multi-fold:

a. introduce Smart Agribusiness, the technologies involved and the main opportunities and challenges,
b. describe the current state of Smart Agribusiness across the world, with an emphasis on industrializing countries,
c. outlay current and expected impact of Smart Agribusiness on job creation and rural entrepreneurship,
d. describe the potential effect of Smart Agribusiness on improving inclusivity across gender, youth and crisis-affected populations, and
e. describe UNIDO's point-of-entry for supporting Smart Agribusiness across the world. •

1 FAO (2019). *Digital Technologies In Agriculture and Rural Areas: Briefing Paper.* URL: http://www.fao.org/3/ca4887en/ca4887en.pdf

1

SMART AGRIBUSINESS

SMART AGRIBUSINESS

Smart Agribusiness refers to applications of digital technologies to improve efficiency of all the stakeholders across interrelated and inter-dependent value chains in agriculture. The primary goal of Smart Agribusiness is to maximize profit for all stakeholders along the value chain while ensuring economic, environmental and natural resource sustainability through the use of digital technologies. Smart Agribusiness finds applications in the following four segments of agriculture:

i. crops,

ii. livestock (and other animal-based products such as honey, milk),

iii. fisheries and

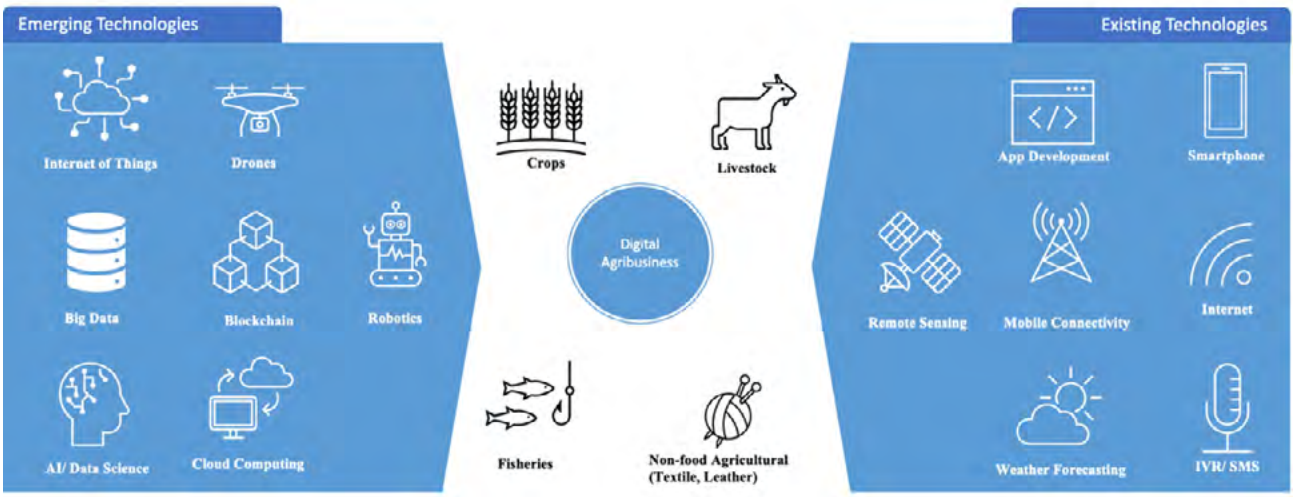
iv. non-food products (such as leather and textile).

A. TECHNOLOGIES ENABLING SMART AGRIBUSINESS

Smart Agribusiness is enabled by the digital technologies that form a part of what is referred to as the "Fourth Industrial Revolution (4IR)". Improvements in the performance, access and cost of computation and data storage, increased internet access and scalability of hardware such as Internet-of-Things (IoT) have led to the rapid growth of digital technologies. Digital technologies can accelerate innovation, lower the costs induced by the scale-up of solutions, increase transparency and promote informed, evidence-based transformation of the agriculture sector.

Based on the current application and usage across the agriculture sector, digital technologies that drive Smart Agribusinesses can be grouped into existing and emerging technologies (*Figure 1*). Specifically, emerging technologies, such as AI, blockchain, drones, IoT and big data analytics, have the potential to enhance productivity and efficiency at all stages of the agricultural value chain.

Figure 1. Existing and emerging technologies driving Smart Agribusiness.



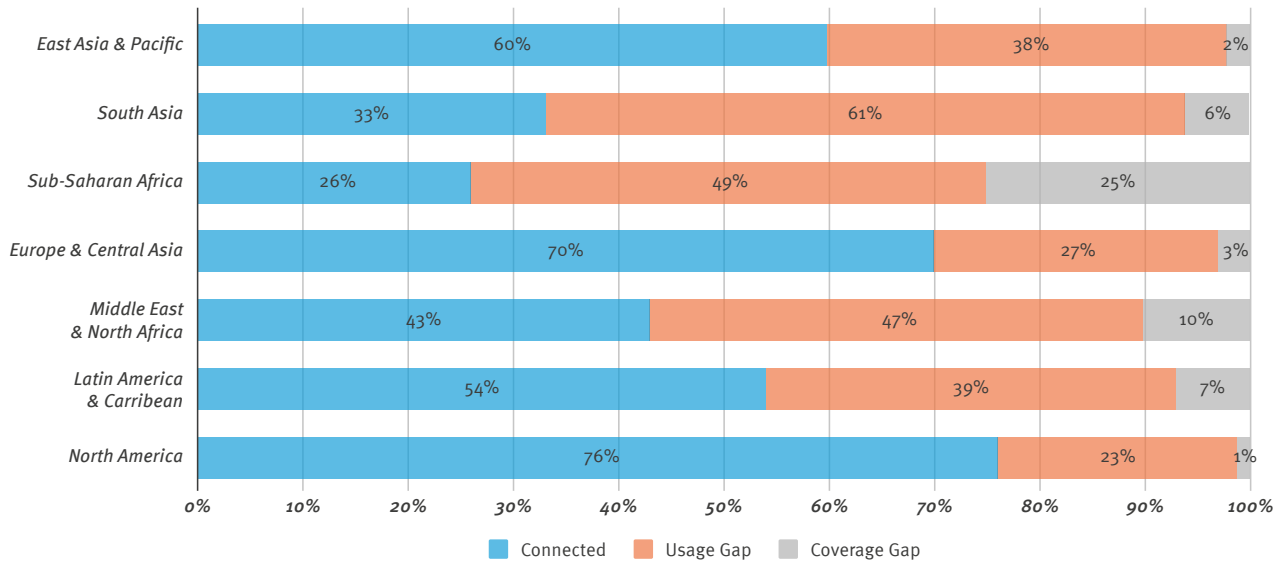


Figure 2. State of mobile connectivity across regions.[2] *"Connected" refers to those who are currently accessing the Internet; "Usage gap" refers to the population who has access to the Internet, but does not use it because of financial or other restrictions; "Coverage gap" refers to those who do not have access to the Internet due to a lack of required infrastructure.*

B. CONDITIONS REQUIRED FOR ENABLING SMART AGRIBUSINESS

There are some basic conditions/constraints that need to be addressed for Smart Agribusiness to positively impact the agriculture sector across a region. These include:

i. infrastructure and connectivity in rural areas,

ii. affordability of access to the Internet,

iii. digital literacy across the population,

iv. a culture of rural entrepreneurship and

v. government / institutional support.

Globally, mobile cellular subscriptions have been growing over recent years. Mobile internet continues to be the primary way in which many users access the internet, especially in the Industrializing countries (ICs). In 2019, 87% of broadband connections in developing countries can be attributed to mobile Internet.[2] *Figure 2* above shows the current state of mobile internet across various regions of the world. The coverage gap (which refers to the population without access to the Internet) has decreased significantly across all regions of the world. The global coverage gap has fallen to 7% of the population - or just under 600 million people in 2019. However, especially in regions including ICs, the usage gap (which refers to those who live within the footprint of a mobile broadband network but are not using mobile Internet services) is still large. In 2019, 3.4 billion people were not accessing mobile Internet services despite living within the footprint of a mobile broadband network. This is true especially in rural areas where the cost of internet access as well as the lack of mobile infrastructure are prominent. If these important constraints are addressed, Smart Agribusiness can take foothold in a region.

Digital literacy is another important prerequisite (especially in ICs and rural areas) for Smart Agribusinesses. The successful development of Smart Agribusiness not only requires basic literacy, but also data handling and communication skills. It is important to note that digital literacy can range from the simplest form of IT skills (e.g. how to use a mobile phone, how to use a weather station, how to sell/procure through e-commerce) to the highly advanced ones (e.g. fertilization planning using satellite imagery). In populations where even basic skills are lacking, digital education must improve rapidly (as in the case of ICs). One key consideration when reflecting on the improvement of digital literacy around the world is understanding how it is likely to affect female and male workers differently

2 GSMA (2020). *Digital Agriculture Maps 2020-State of the Sector in Low and Middle-Income Countries.* URL: https://www.gsma.com/r/wp-content/uploads/2020/10/GSMA-Agritech-Digital-Agriculture-Maps-2020-1.pdf

due to differences in digital skills and technology use. Similarly, rural areas in particular are lagging behind in the process of gaining digital skills (*Figure 3* below). There is a need to develop a model of digital skills training tailored to farmers and other vulnerable groups along the agribusiness value chains, which can enable them to learn to assess and implement best practices and technologies for their farm business.

A culture of rural entrepreneurship is especially important for the success of Smart Agribusiness. Globally, there is an increasing number of initiatives to foster digital entrepreneurial activity related to the creation, development and scaling-up of 'digital start-ups', including in the agriculture and food sector. Creating a sustainable entrepreneurial culture for Smart Agribusiness is a long-term political and practical process, starting with appropriate education in schools. It requires an enabling environment which allows risk-taking, trust-based relationships between stakeholders, financial opportunities, professional services, a sustainable digital ecosystem, the availability of appropriate skills and an attitude of sharing or 'open innovation'. Programmes and investments on Smart Agribusiness will be more sustainable if rural women and youth play an active role in the digital ecosystem.

This can be done, for example, by strengthening their capacities and promoting entrepreneurship, by ensuring equitable access to productive resources and services, by improving participation in decision making and by better addressing socio-cultural issues in policies.

C. OPPORTUNITIES FROM SMART AGRIBUSINESS ACTIVITIES

Opportunities arise from the current issues that exist at various stages of agriculture value chains. Smart Agribusiness presents multiple opportunities to transform the current state-of-the-art in all four segments of agriculture:

a. crops,

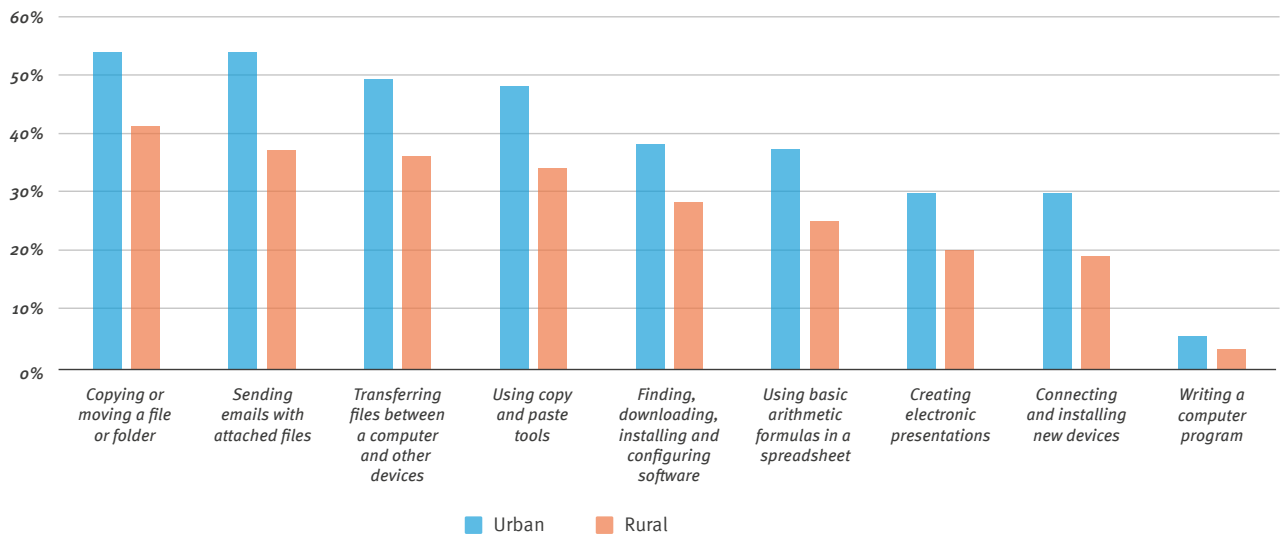
b. livestock,

c. fisheries and

d. non-food products.

Figure 4 (next page) lists the opportunities presented by Smart Agribusiness and how it benefits the various stakeholders involved. •

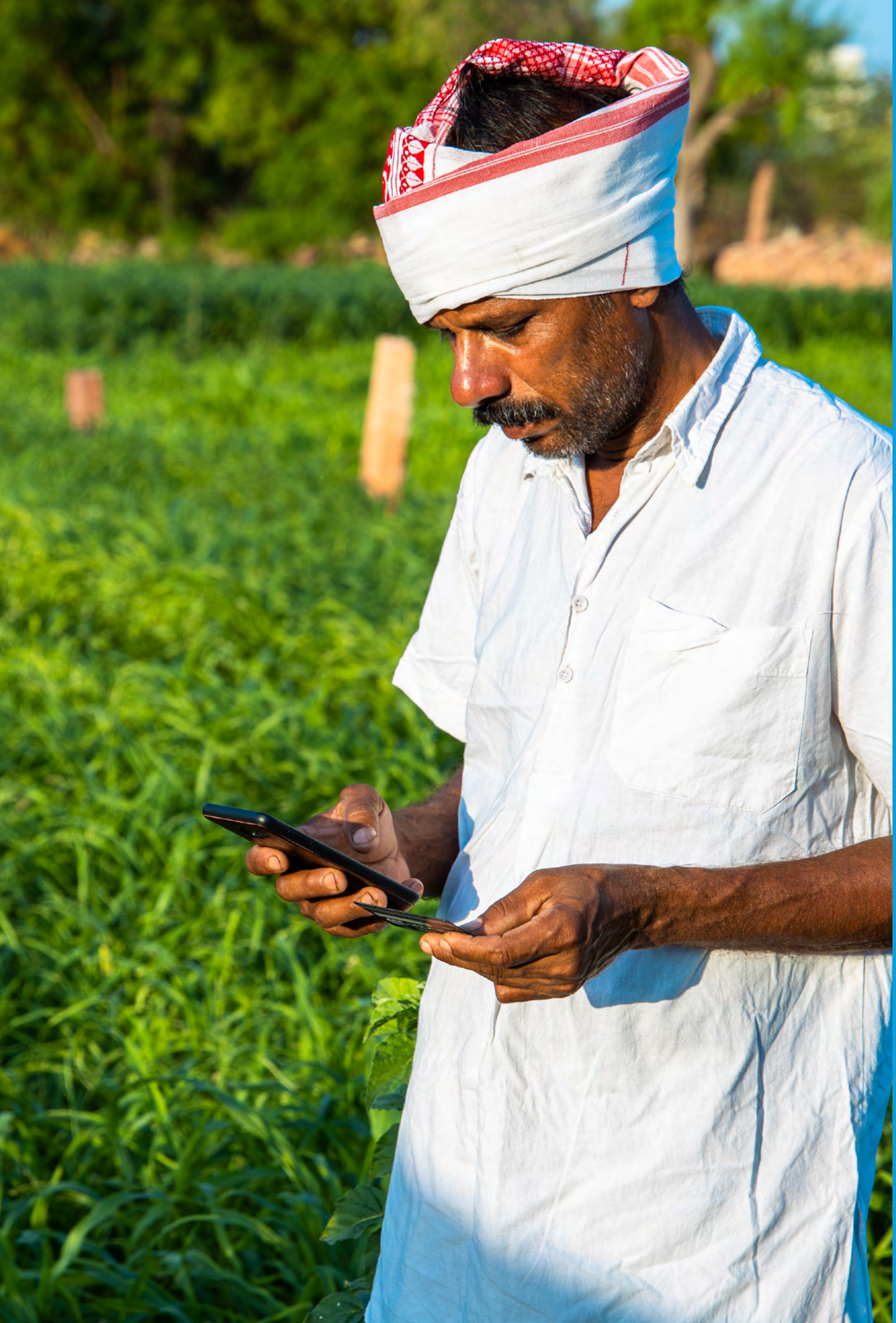
Figure 3. Digital literacy of rural and urban populations around the world, as measured by their ability to perform specific digital tasks.[3]



3 ITU (2018). *Measuring the Information Society Report: Volume 1*. Geneva: ITU.

Figure 4. Opportunities provided by Smart Agribusiness to solve critical gaps in agriculture value chains and corresponding categories of stakeholders.

	Pre-production	Production	Post-harvest	Consumption
Benefits for Farmers	• Access to high-quality and affordable inputs • Soil fertility management	• Access to information on best agronomic practice • Access to timely, geography-specific and actionable weather, pest and disease, and market information • Access to mechanization • Access to agricultural finance	• Access to market • Reducing post-harvest losses • Limited storage and warehousing	• Visibility to consumer • Possibility to access short supply chains
Benefits for Input-Suppliers	• Information on demand for input	• Forecasting in-season of suppliers required by farmers • Increased loyalty through e-vouchers, loyalty programmes		
Benefits for Service Providers		• Information on demand for products and services such as machines		
Benefits for Off-takers			• Surety of supply • Optimizing procurement plan • Reducing food loss and waste/ Food quality	
Benefits for Consumers				• Greater visibility on product quality
Benefits for Financial Providers	• Improved understanding of farmer's financial health. • Greater clarity in execution of farming insurance schemes			
Benefits for Society	• Reduced bias across gender, economic and regional barriers • Improved execution of government schemes such as subsidies			



2

CURRENT GLOBAL STATE OF SMART AGRIBUSINESS

CURRENT GLOBAL STATE OF SMART AGRIBUSINESS

Over the last decade, Smart Agribusinesses have sufficiently grown to become commercially viable. As they become commercially viable, these Smart Agribusinesses are beginning to have a positive impact on smallholder farmers and agriculture in ICs. From agronomic advisory to e-commerce, Smart Agribusinesses are improving agricultural knowledge, enhancing harvests, boosting farmer incomes while ensuring sustainability of natural resources, enabling transparency across the supply chain, reducing food loss/ waste and improving consumer confidence. In ICs, the number of Smart Agribusinesses has increased from around 50 solutions in 2009 to nearly 700 active solutions in 2020.[4]

One could group these Smart Agribusinesses in the following categories:

a. digital advisories, which provide advisory on agricultural practices,

b. digital procurement, which facilitates procurement of harvest/ produce from farm gate to the consumer,

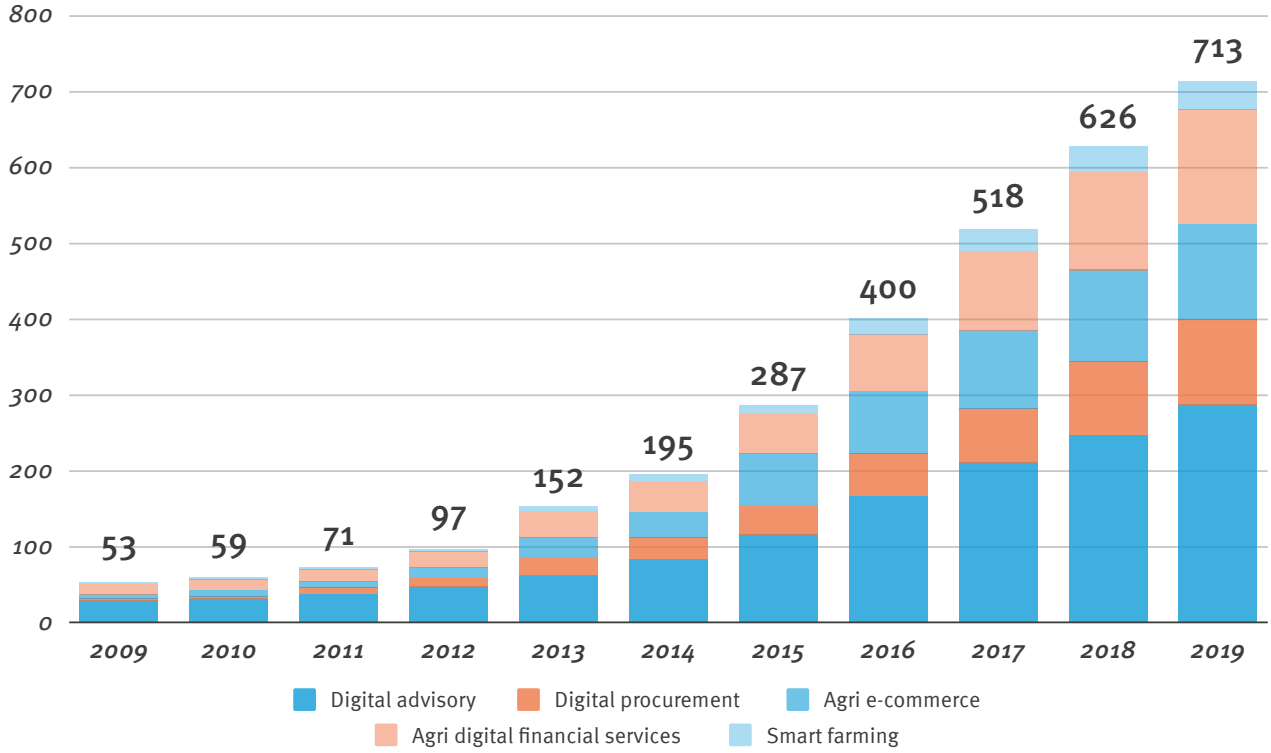
c. agri e-commerce, such as Dehaat (India),

d. agri-digital financial services, such as Arifu (Africa) and

e. smart farming, such as DigiFarm (US).

While digital advisories and smart farming seek to improving on-farm activities, digital procurement, agri e-commerce and agri-digital financial services form the off-farm activities. *Figure 5* below shows the growth of Smart Agribusinesses in the ICs.

Figure 5. Growth of different types of Smart Agribusiness across the world from 2009-2019.[4]



4 GSMA (2020). *Digital Agriculture Maps 2020 - State of the Sector in Low and Middle-Income Countries.* URL: https://www.gsma.com/r/wp-content/uploads/2020/10/GSMA-Agritech-Digital-Agriculture-Maps-2020-1.pdf

Some trends can be observed in the current state of Smart Agribusiness around the world. Off-farm Smart Agribusinesses (e.g. digital procurement, agro e-commerce and agri-digital financial services) have experienced a tremendous growth in both developed and developing countries. This is because off-farm inefficiencies presented the biggest opportunity for private sector to realize profits. Hence, it is natural to see that off-farm based Smart Agribusinesses have taken a firm footing. Startups such as DeHaat (India) have achieved substantial growth by closing the gaps in agri-input supply chains as well as in agri-produce supply chains. Within the category of on-farm digital businesses, digital advisories have had the highest levels of activity.

However, these efforts have largely been led by NGOs and governments, with a minimal commercial motive. Efforts in smart farming technologies have been explored mainly in the developed world. In the ICs, use of smart farming technologies has been largely restricted to on-farm weather stations. Given their higher degree of formalisation, cash crop value chains (such as coffee, tea, cocoa and dairy) seem to have experienced the strongest push to deploy digital tools.

These digital tools have ranged from improving production visibility to reducing the costs of operation and digitization of financial transactions. However, these efforts also have the potential to benefit many other stakeholders beyond smallholder farmers. It is widely recognised that technology has an inherent bias in favour of the more educated and economically-stronger players within any given value chain. It is important to calibrate these efforts to equally benefit all players along the agribusiness value chain. Informal agricultural supply chains (e.g. cereals, fruits and vegetables) have not yet experienced a significant impact of Smart Agribusinesses. This is because of the fragmented nature of these supply chains, first mile and last mile issues as well as lower economic viability for procurers and other stakeholders.

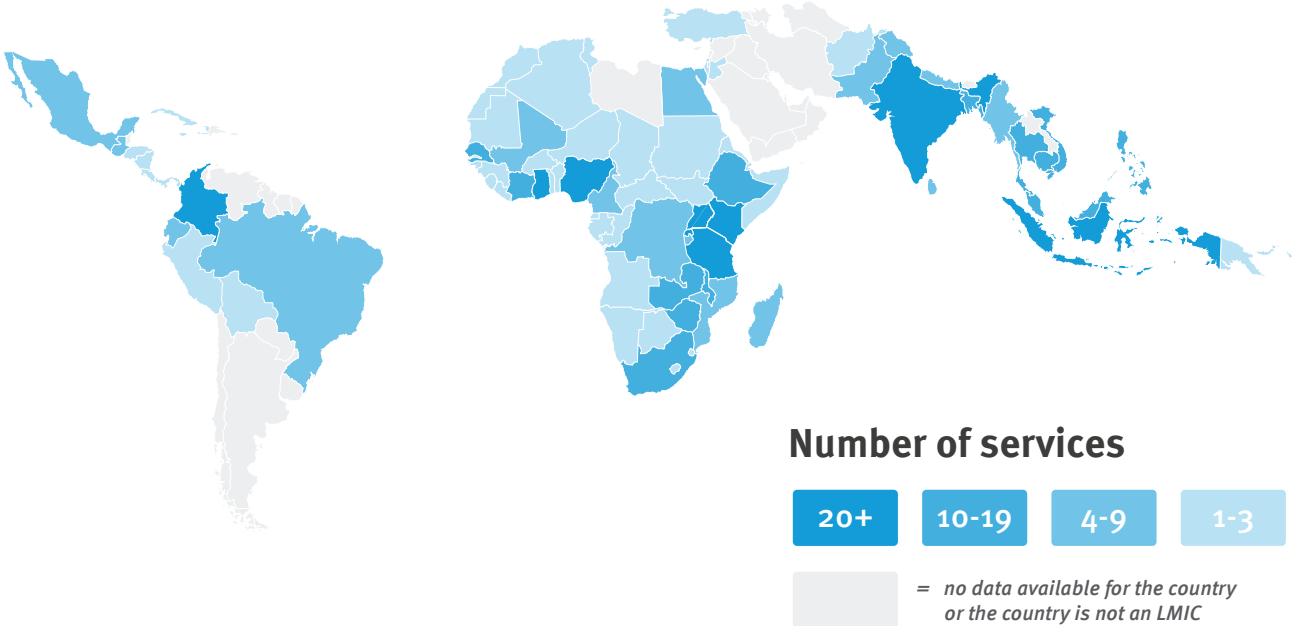


Figure 6. Growth of different types of digital agribusiness across the world from 2009-2019.[5]

The presence of an enabling regulatory environment has fostered increased levels of innovation among Smart Agribusinesses such as mobile money businesses. For example, digital payment regulations in India, have increased the use of digital payments across the country. Similar actions in some parts of Africa (e.g. Kenya, Rwanda, Nigeria) have yielded increased participation of farmers in digital payment systems, which has in turn led to improved access to finance and insurance services.

Smart Agribusinesses that demonstrate patience in their activities and scale-up plans tend to become more financially sustainable. As Smart Agribusinesses are rural businesses, the digital literacy and financial health of those consuming the services have been identified as the main hurdles. Therefore, onboarding, education and mobilisation of farmers and of other value chain actors are important considerations for Smart Agribusinesses. Technology companies tend to expect quicker returns on their investments. It is important that there are enough government-schemes and sufficient levels of donor/investor funding encouraging Smart Agribusinesses to overcome this major hurdle and to focus on the long-term vision.

> **"Smart Agribusinesses that have shown patience in their activities and scale-up plans tend to become more financially sustainable.**

5 GSMA (2020). *Digital Agriculture Maps 2020 - State of the Sector in Low and Middle-Income Countries.* URL: https://www.gsma.com/r/wp-content/uploads/2020/10/GSMA-Agritech-Digital-Agriculture-Maps-2020-1.pdf

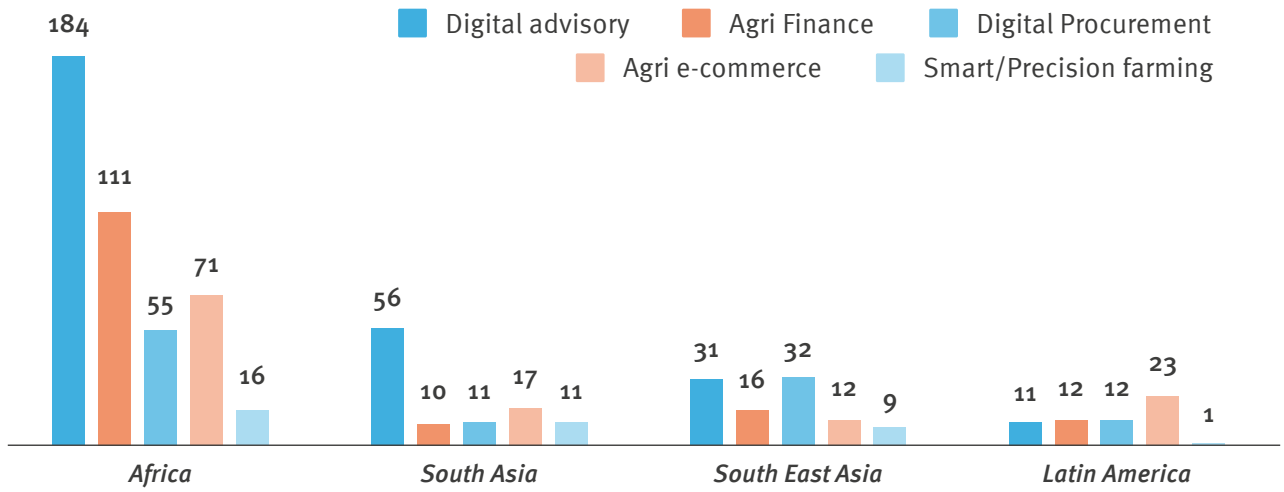
> *It is important that there is enough donor/ investor funding as well as government-schemes encouraging digital agribusinesses to focus on the long-term vision.*

A. REGIONAL TRENDS

Figure 7 below shows the number of Smart Agribusinesses operating in ICs across major regions of the world. One can identify a few trends across these Smart Agribusinesses. **Digital advisories are well represented across all regions.** The reasons for this trend are the relatively low barrier-of-entry to create a digital advisory service and the motivation of entrepreneurs in the ICs to support farmers. **Smart farming does not seem to be well-represented across the ICs,** unlike in developed countries, where farms are relatively large and farmers are more financially stable than smallholders.

Ghana, Nigeria, Uganda, Kenya and Tanzania have the highest numbers of Smart Agribusinesses across ICs in Africa, with digital advisory being the dominant agribusiness use case. In South Asia, India dominates the Smart Agribusiness landscape. South Asia was also one of the first regions to launch and to scale up Smart Agribusiness solutions. Some of the start-ups in South Asia (Satsure, CropIn, AgNext among others) have been able to scale-up their operations beyond their region. Indonesia and Columbia lead the Smart Agribusiness landscape in Southeast Asia and across Latin America and the Caribbean respectively. It is interesting to note that the presence of cash crops (e.g. coffee) appears to have fostered the adoption of Smart Agribusiness solution in Latin America.

Figure 7. Plot showing active Smart Agribusinesses across the ICs in major regions of the world.[6]



6 GSMA (2020). *Digital Agriculture Maps 2020 - State of the Sector in Low and Middle-Income Countries.* URL: https://www.gsma.com/r/wp-content/uploads/2020/10/GSMA-Agritech-Digital-Agriculture-Maps-2020-1.pdf

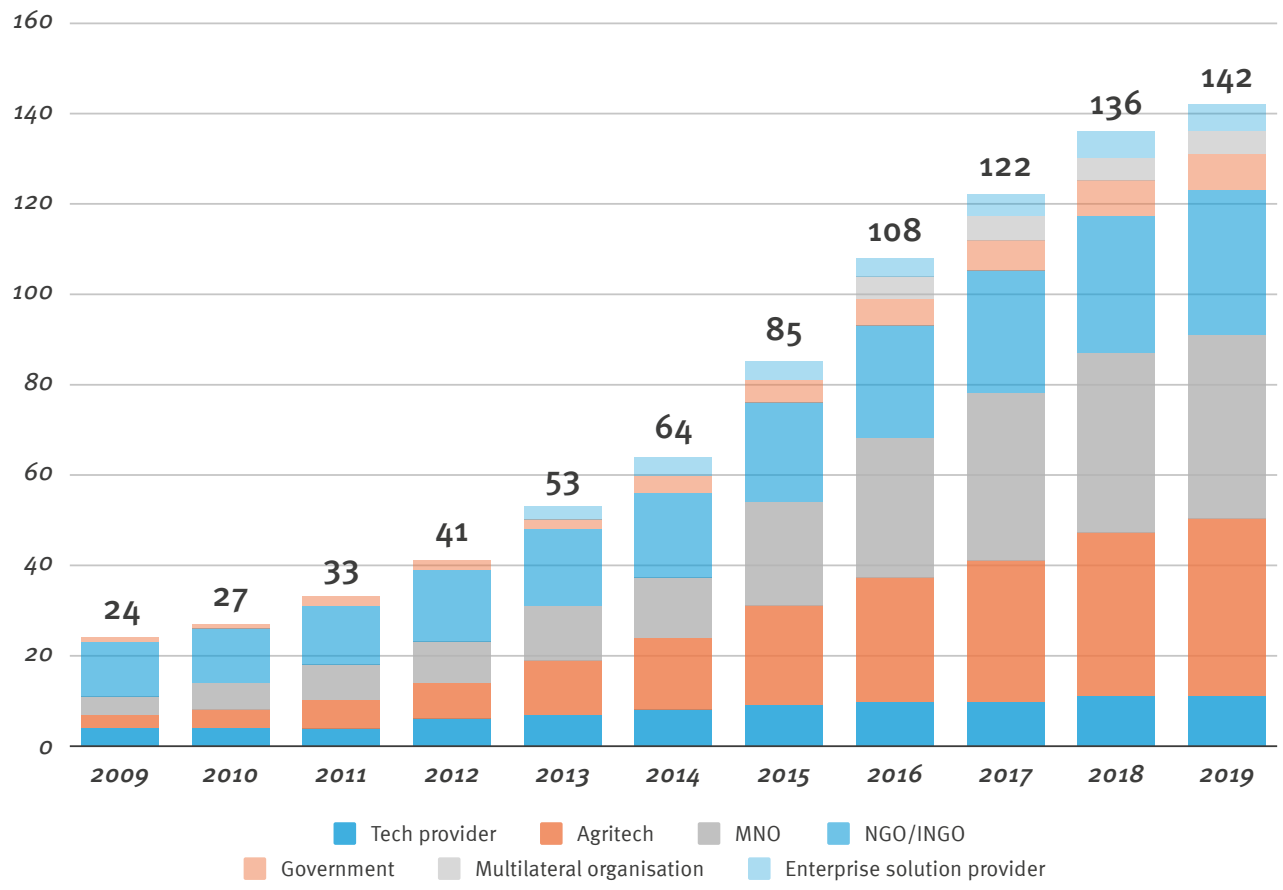


Figure 8. Number of active Smart Agribusinesses serving digital advisory services across ICs, grouped by type of service provider.[7]

B. TRENDS AMONG TYPES OF SERVICE PROVIDERS

As digital advisory is the dominant service provided by Smart Agribusinesses, it would be helpful to analyse the type of service providers involved in this activity (see *Figure 8* above). Such an analysis would help us to understand how Smart Agribusinesses can organically find collaboration opportunities in order to become commercially viable and to scale up.

Given that limited mobile usage is a major bottleneck for Smart Agribusinesses across ICs, Mobile Network Operators (MNOs) have become key players for Smart Agribusinesses to scale up. Advisory services are delivered by a range of service providers, including MNOs, Agricultural Value Added Services (Agri-VAS) providers and NGOs. In some cases, these advisory services are delivered by technology vendors, governments and regulatory agencies (often in partnership with MNOs).

Smallholder farmers are not able to pay for Smart Agribusiness services. In this context, three types of direct business models have been growing organically across ICs: business-to-consumer (B2C), business-to-business (B2B) and a hybrid of both, such as Dehaat (India) and DigiFarm (Africa). In addition, business-to-government (B2G) models have emerged where national or regional governments pay for services on behalf of farmers. •

7 GSMA (2020). *Digital Agriculture Maps 2020 - State of the Sector in Low and Middle-Income Countries.* URL: https://www.gsma.com/r/wp-content/uploads/2020/10/GSMA-Agritech-Digital-Agriculture-Maps-2020-1.pdf

3

SOCIETAL IMPACT OF SMART AGRIBUSINESS

Photo Source: WSIS Photo Contest 2020 (World Summit on the Information Society Photo Contest 2020)

SOCIETAL IMPACT OF SMART AGRIBUSINESS

The societal impact of Smart Agribusiness is one of the primary motivations for UNIDO's participation in the field. In theory, Smart Agribusinesses can have a democratizing effect across the agricultural sector. They have the potential to positively impact the livelihoods of all those involved in the agriculture sector, irrespective of societal divides (e.g. gender, age and economic status among others). For example, youth can be incentivised to take up agricultural businesses through the use of digital technologies, which can eventually contribute to a reduction in the rural-urban divide. However, without close monitoring and soundly designed policies to guide Smart Agribusinesses, there is the risk of widening the digital divide in agriculture and associated sectors. In fact, given the basic requirements of digital literacy and access / affordability, technology has an inherent bias towards societal classes that are traditionally better-off.

If policymakers create job-training programs and invest in skills development to equip workers with the required capabilities to harness new technologies, Smart Agribusinesses can have a positive impact on the social fabric of our societies.

A. JOB CREATION

As Smart Agribusinesses develop rapidly, forecasts about the future of the agricultural workforce and rurality have been divergent. Given the bias of most technologies in favour of skilled labour, some scholars argue that agricultural technologies will eventually result in a monopolistic landscape leading to further capital accumulation and land degradation. It has been argued that this will ultimately contribute to the exploitation of marginalized stakeholders (such as smallholder farmers and daily wagers), and will reinforce social, economic, and racial inequities in labour / skills development. Other scholars argue

that digitization can positively contribute to growth in rural communities by creating new workplace opportunities, provided that proper guidance from policymakers is ensured. In the end, it is fair to expect that Smart Agribusinesses will create a segmentation of new jobs arising in the agriculture sector; with jobs that involving low-cost and less-skilled labor on the one hand and jobs accessible to a highly-skilled, digitally-driven workforce on the other.

The agriculture sector has a high demand for low-cost labour required for relatively low-skilled on-farm activities such as harvesting, grading and field management among others. Smart Agribusinesses are expected to have a positive impact on these labour categories. For example, some horticultural operators are beginning to invest in new automated labour-saving technologies in the areas of transplanting, pesticide application and grading. Automation in the agriculture sector is projected to rise to 28% overall by 2030, while the 'projected potential' for automation could reach 52%. Farm automation might be beneficial for farmers in the developed world, as farm labour requirements are currently met by migrant workers. On the other hand, the impact of farm automation is unclear, in the context of smallholders and ICs.

A key impact of Smart Agribusinesses is an increased transparency across the value chain. Off-farm agricultural jobs can be expected to go through a transformation process due to Smart Agribusinesses. For example, it may be expected that there will be a surge in low-skilled digitally-powered jobs in logistics, distribution, storage and extension services among others. Therefore, it is necessary that capacity development for basic digital skills is ensured across a region of interest. Some basic digital skills that are relevant for these jobs are using mobile-based solutions, GPS tagging, digital logging of activities and digital scanning of documents.

The evolution of Smart Agribusiness across the world is expected to increase the demand for highly-skilled jobs. These will include data analysis, AI and robotic design, digital agriculture extension experts, digital field-services related jobs as well as cloud-based technologies and e-marketplaces. Expected job growth in agricultural science, engineering, information technology and other high-skilled jobs is a concern for rural agricultural

employees in particular. Although it has been noted that digitalization, (e.g. deployment of broadband) can bring service sector jobs to the rural economy, it remains unclear how jobs in primary agricultural production will be impacted.

Another concern is the concentration of Smart Agribusiness services among a few large agricultural and Information Technology companies. In fact, in the past a number of start-ups that were commercially viable have been acquired by some large companies. Such an evolution of digital agriculture, could also ultimately lead to a reduction in the number of highly-skilled jobs created by Smart Agribusinesses.

B. DIGITAL SKILLS DEVELOPMENT AND ENTREPRENEURSHIP

Limited digital skills development in rural areas and the lack of a culture of rural entrepreneurship present the biggest bottlenecks for Smart Agribusinesses to equally benefit the rural economy. While several skills development and entrepreneurship programs have been implemented by governments and NGOs around the world, they have been largely restricted to urban populations.

For rural communities (especially in the ICs) to benefit from Smart Agribusinesses, there is a need to provide opportunities that allow rural populations to improve both their (a) digital literacy and (b) digital agricultural skills.

Digital entrepreneurship involves the transformation of existing businesses through new digital technologies and the creation of innovative enterprises characterized by:

i. the use of digital technologies to improve business operations,

ii. the invention of new (digital) business models and

iii. the engagement with customers and stakeholders through new (digital) channels.

Modern day farmers may be particularly suited to entrepreneurial activities. Nowadays, farmers frequently design business plans, scout for funding, make use of farming enterprise 'incubators' and

Photo Source: WSIS Photo Contest 2020
(World Summit on the Information Society Photo Contest 2020)

attend scientific conferences. Young farmers in particular are also more likely to take educated risks and adopt innovative approaches in their farm management. For example, in Italy over 12 000 agricultural start-ups were created in 2013 by men and women aged 25 to 30.[8] Similarly, between 2016 and 2018, the mobilisation of the inherent innovation capacity that exists in rural communities has led to the creation of over 42 agtech startups in Kenya, Namibia and Rwanda.

C. GENDER, AGE AND OTHER FORMS OF INCLUSIVITY

Under the right conditions and appropriate supporting policies, Smart Agribusiness has improved inclusivity across all societal divides. For example, it has been noted that digital agricultural platforms have positively impacted the livelihoods of women farmers in Africa. Women have increased yields on their farms due to the knowledge gained on the platforms on better agricultural practices, and enhanced access to high-quality and certified inputs (as observed by start-ups such as DigiFarm and Arifu).[9] The lack of access to knowledge and resources has a significantly larger negative impact on women than men due to the social restrictions faced by the former. Start-ups such as Digifarm and Arifu digital enable access to knowledge and resources which tend to benefit women much more than men.

It has been reported that digital services, such as mobile money, help women farmers to increase savings and financial resilience, and enter the formal banking system.[10] Platforms that offer safe storage of money and the ability to track expenses on a platform also result in better financial planning and budgeting. One study reported that women farmers have seen an improvement in their lifestyles while others note that women can gain greater control over their personal finances through digital options.[11]

In general, a range of factors prevent youth from engaging in agricultural production:

- obstacles in gaining access to capital, land, and productive assets;
- marginalisation in decision-making processes around family and community assets
- lack of collateral and ability to accumulate assets affects long term access to financial services, savings, and loan opportunities, including credit
- migration for employment and to contribute to household incomes.[12]

We need to build the agency of youth to navigate and negotiate opportunities for more sustainable futures. This needs to be done in the context of opportunities for employment, capacity development and access to resources, including improving productivity, adaptive capacities. Smart Agribusinesses are well suited for encouraging youth to consider agriculture as a profession. This is because youth tend to be digitally literate. In 104 countries, more than 80 percent of the youth population have an online presence. The proportion of young people aged 15-24 using the Internet (71 percent) is significantly higher than the proportion of the total population using the Internet (48 percent). In Africa, 37 percent of individuals using the Internet are young people aged 15-24, compared with 13 percent in developed countries and 23 percent globally. Examples of digital-based agribusinesses include Hello Tractor, the Manobi AgCelerant[13] program, and others.

Smart Agribusiness has the potential to provide crisis-affected populations (such as refugees and internally displaced people) with job opportunities. However, given the requirement of digital literacy and of access to the internet, these opportunities might be limited to low-skilled jobs if not paired with digital capacity development and technological literacy training. •

8 Coldiretti, 2018. Report for the agrifood forum of Cernobbio. 2018. Trieste: Instituto Ixe Srl [In Italian].

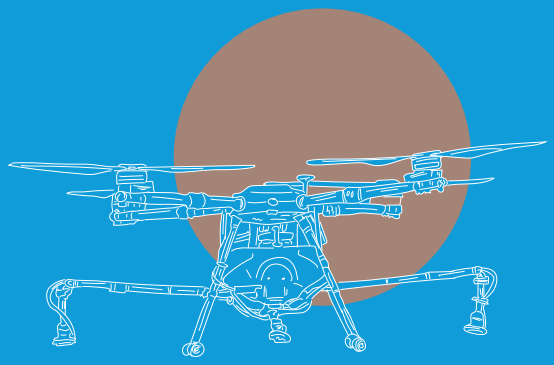
9 https://www.mercycorpsagrifin.org/2021/05/25/digital-services-women-smallholder-farmers/

10 Suri, T., & Jack, W. (2016). The long-run poverty and gender impacts of mobile money. Science, 354(6317), 1288–1292. https://doi.org/10.1126/science.aah5309

11 Ndiaye, O. K. (2013). Is the success of M-Pesa empowering Kenyan rural women? Feminist Africa, 18, 156–161. http://www.agi.ac.za/sites/default/files/image_tool/images/429/feminist_africa_journals/archive/18/standpoints_is_the_success_of_m-pesa_empowering_kenyan_rural_women_.pdf

12 Bullock et al, 2020

13 https://hellotractor.com, https://agcelerant.com.



4

UNIDO POINTS-OF-ENTRY FOR SMART AGRIBUSINESS SUPPORT

UNIDO POINTS-OF-ENTRY FOR SMART AGRIBUSINESS SUPPORT

The last decade has seen a significant number of Smart Agribusinesses across the agricultural supply chain (see *Figure 9* below). TThese Smart Agribusiness applications have generally crowded the production and retail/consumption segments of the supply chains. From private sector to governments to inter-governmental organizations, the focus has mostly been on the production segment. UNIDO's points-of-entry lie in the upstream and downstream segments of the supply chain. *Figure 9* below shows the supply chain segments that provide the most opportunities.

A virtual Expert Group Meeting, organized on 28 September 2021, examined UNIDO's potential points-of-entry from three dimensions:

1. Human Capital Development,
2. Creating Pathways for Smart Agribusinesses,
3. Precision Agriculture.

The following sections summarize findings from the Expert Group Meeting.

A. HUMAN CAPITAL DEVELOPMENT

By human capital development we mean the skills, knowledge, and experience possessed by an individual or population on a particular topic, such as Smart Agribusiness. UNIDO should aspire to develop human capital that achieves grass-root engagement (through rural entrepreneurs, cooperatives, self-help groups and a broad constituency of small-holders). Low-tech delivery mechanisms need to be encouraged along with high-level technologies, in order for inclusivity across social classes to be achieved. Specifically, we identify the following points-of-entry:

- Working with governments and NGOs to promote digital skills development programs in rural areas as well as agtech skills improvement (with a specific emphasis on gender, age and other forms of inclusivity).
- Supporting customizations of national policies (e.g. rural development, sectoral masterplans, infrastructure development plans, agribusiness strategies) to ensure they better address skills gaps, especially in rural areas.

Figure 9. Applicable Smart Agribusinesses across a typical agriculture supply chain and UNIDO's points-of-entry (highlighted in light red).

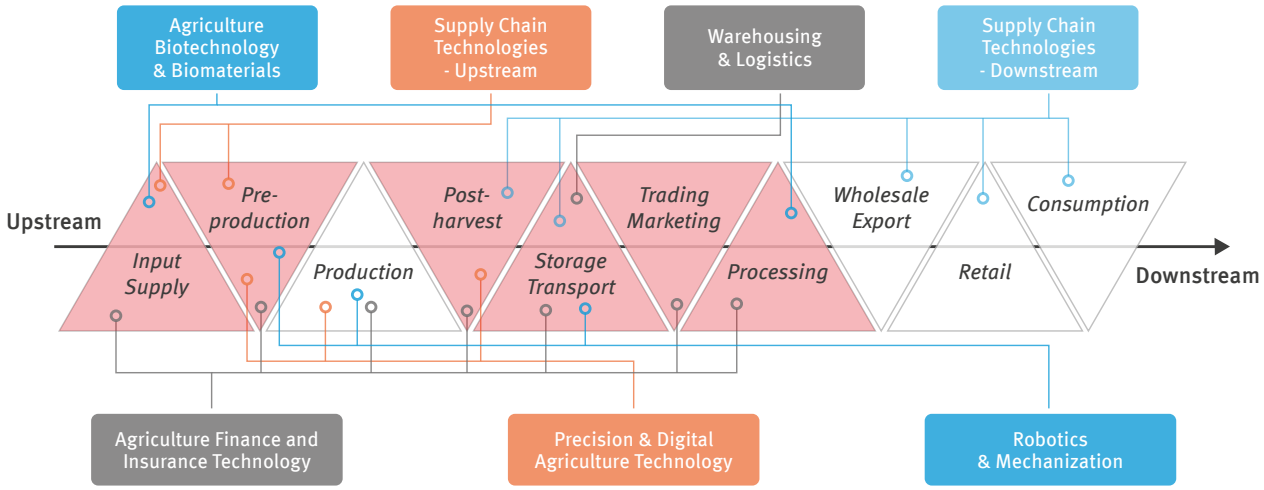


Photo Source: WSIS Photo Contest 2020
(World Summit on the Information Society Photo Contest 2020)

> ***"UNIDO aspires to develop human capital that achieves grass-root engagement***

- Helping bridge the distance between NGOs already operating at the grass-root level and the private sector, to boost (digital) rural entrepreneurship.
- Supporting the re-visiting of regulatory frameworks on a regular basis, to facilitate private sector engagement.
- Helping to re-frame rural development policies so that they are well integrated in a given country's industrial development strategy.

B. CREATING PATHWAYS FOR SMART AGRIBUSINESSES

Smart Agribusinesses can thrive when the ecosystem is conducive for their acceptance. UNIDO's key role could be in strengthening this ecosystem, while creating efficient pathways for Smart Agribusinesses to be launched. This would also require that digital literacy is high, technology use-gap is minimal across social classes and government and policies support the use of digital technologies. UNIDO's specific points-of-entry in this respect could be the following:

- Encouraging the co-creation of Smart Agribusiness solutions by convening multiple stakeholders.
- Improving the access to critical datasets such as satellite imagery to start-ups, who are in turn encouraged to provide satellite-imagery based services to farmers.
- Working with the private sector to create smart manufacturing solutions (in the lower and

upper segments of the agribusiness value chains)

- Working with partners (e.g. FAO, IFAD, WB) to create a Smart Agribusiness formulation and implementation toolkit, which can be used by the public and the private sector to create sustainable and viable Smart Agribusiness solutions.
- Collaborating with fast-moving consumer goods (FMCG) and with other agro-based industries to increase awareness of Smart Agribusiness bottlenecks and opportunities in ICs. Such partnerships could also promote reduction of food loss and waste across agricultural supply chains and improve their sustainability. This can be accomplished through technologies such as blockchain, which are used to track and trace food products as they move along the supply chain.
- Collaborating with academic and research institutions to measure the sustainability of various agriculture-based industrial operations. These efforts could include automated carbon emission measurements in farms through digital technologies.
- Working with the leading private sector agricultural companies to improve customer awareness of nutrition and sustainability scores of food-based products. For example, new QR-based technologies could inform the consumer about products.
- Given the current state of Smart Agribusinesses' focus on digital advisories, working with large e-commerce platforms to create a platform for smallholder farmer collectives to be able to get the best pricing for their harvests.
- Working with government agencies to improve the operational efficiency and market visibility of smallholder farmer collectives, especially for cash crops such as cocoa in Ghana and coffee in Columbia. Smart Agribusiness solutions such as blockchain can help in traceability and product quality assurance, leading to better price realization for farmers.

Photo Source: WSIS Photo Contest 2020
(World Summit on the Information Society Photo Contest 2020)

- Collaborating with manufacturers and academic institutions to apply technologies on the production side that do not require connectivity. These can be maintained without significant investment but will still provide crucial information for users to make better decisions to increase their production or improve its quality (either on-farm or off-farm).

> ***"Smart Agribusinesses can thrive when the ecosystem is conducive for its acceptance. UNIDO's key role could be in strengthening this ecosystem, while creating efficient pathways for Smart Agribusinesses to be adopted.***

C. PRECISION AGRICULTURE

Precision agriculture (PA) requires a number of enablers to thrive, including mechanization in on-farm operations, physical infrastructure, digital connectivity and financial capital. Smaller farmers / operators lack access to mechanization in their operations as a starting point for adopting PA technologies, as well as the necessary investment and skills required to capitalize on PA technology. An enabling environment that connects commercial farm operations, government and small farmers / operators is required to fully capitalize on efficiencies gained during crop production. Strengthening of digital literacy, education delivery mechanisms, networks and partnerships as well as incentivising young people to enter the agriculture sector through technology are required to establish an ecosystem for PA to be adopted by smaller farmers / operators. UNIDO's role in precision agriculture could be:

- Establishing hubs/bridges to commercial operators (e.g. farm level, food industry) with a social responsibility dimension to introduce new technologies and uptake by small operators and farmers that are working to service these large private investments.
- Assisting small farmers/operators in this ecosystem with a commercial operator to adopt precision agriculture technology including bridging and strengthening of digital literacy.
- Working with technology developers/ manufacturers to introduce lower cost/lower tech solutions that can be adopted, including systems that can work with limited or low bandwidth connectivity, but can be deployed at scale (i.e. variable rate, soil sampling, etc).

CONCLUSION

CONCLUSION

UNIDO can play a key role in the development of Smart Agribusinesses across the world (particularly in the ICs) and the topic will be one of the pillars of UNIDO's Strategic Framework of 4IR. The current state of Smart Agribusinesses across the world indicates a particular focus on the production phase of the agricultural supply chain. The relative lack of digital solutions upstream/ downstream of the production phase of agriculture supply chains seems to provide a good opportunity for UNIDO, in line with its mission of promoting and accelerating inclusive and sustainable industrial development in Member States.

The main opportunities lie in the areas of human capital development, facilitating pathways for Smart Agribusiness growth and precision agriculture solutions. Digital literacy is a key enabler of Smart Agribusiness. In the area of human capital development, UNIDO can play a key role in improving the digital and agtech skills of the workforce, especially in rural areas. For example, this role can translate in supporting customizations of national policies to better address skills gaps or bringing multiple stakeholders together (NGOs, private sector and government).

Creating pathways for Smart Agribusiness growth is contingent on the presence of the right ecosystem. An ideal ecosystem would have good digital literacy across social/gender classes, relatively low cost of access to the internet, conducive policy and regulatory frameworks as well as the presence of a culture of entrepreneurship in rural areas. Currently, these ecosystems are not robust enough in rural areas globally, especially in the ICs. One solution is for a global player to facilitate partnerships between multiple actors towards this common mission. In this regard, UNIDO's key role is also in convening various actors across the digital ecosystem to allow for frugal and inclusive Smart Agribusiness development. Another solution could be the creation of a global knowledge portal that would serve as a centralized repository of knowledge for digital solutions, improve farmers' access to state-of-the-art agronomic/ scientific breakthroughs and support human-centred design for rural digital solutions.

Precision agriculture solutions present an attractive

option for the future of agriculture operations. However, use of precision agriculture solutions requires that farmers (especially in the ICs) are able to understand and use these solutions. UNIDO can play a key role in supporting customization of such precision agriculture solutions to improve their adoption. While advanced precision agriculture solutions will take time to be accepted across ICs, UNIDO can support the promotion of low-technology precision agriculture solutions. •

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