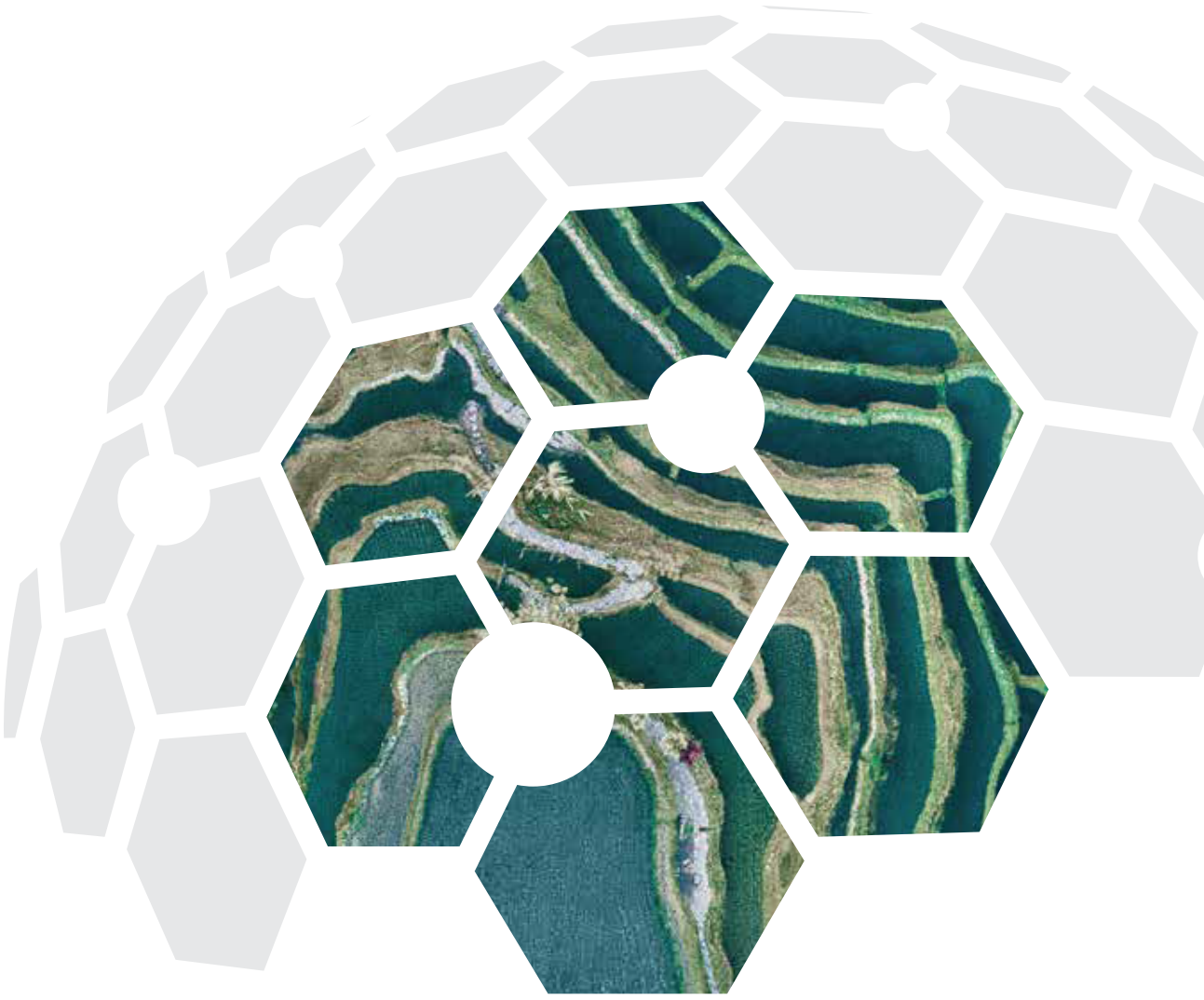
REALIZING OPPORTUNITIES FOR THE 21ST CENTURY THROUGH RESILIENT GLOBAL VALUE CHAINS

AGRI-FOOD



IsDB
البنك الإسلامي للتنمية
Islamic Development Bank

THE FUTURE
Volume 4

Aerial view of rice terraces, Tegallalang, Bali, Indonesia

Drone monitoring can reduce the high manual labor involved with monitoring and mapping of farmland

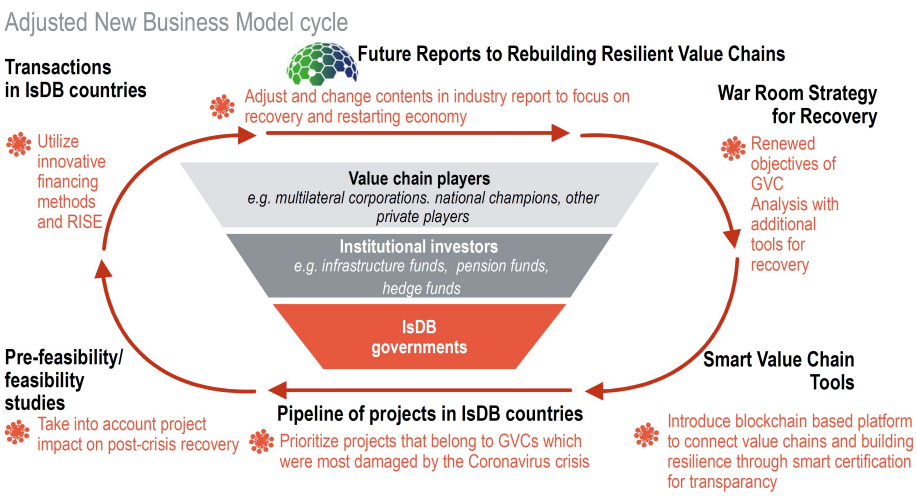
REALIZING OPPORTUNITIES OF THE 21ST CENTURY THROUGH RESILIENT GLOBAL VALUE CHAINS

By 2030, the agri-food sector must be able to feed 8.6 billion people all over the globe, which will require substantial production increases. The coronavirus pandemic and the Great Lockdown have revealed to the world the importance of having a resilient and robust agri-food value chains. IsDB Member countries need to take immediate actions to prevent any prolonged and sustained negative effects from the pandemic that may threaten the future prospects of both supplying and consuming countries.

IsDB member countries need to take action now to create additional resources, increase their productivity and transform their business models in order to support stable growth and innovation. Within this report, IsDB offers an in-depth view on key trends and initiatives that will shape the future of its 57 members through 2030 and beyond.

These initiatives require strong partners to jointly drive investments and disseminate knowledge in IsDB member countries. Looking ahead, such investments will unlock IsDB member countries' potential for adequate employment and equitable living conditions, while providing private sector partners with access to some of the fastest growing economies worldwide.

To create and sustain a virtuous cycle for partnership and investment, the IsDB adopted a new business model that aims to Make Markets Work For Development. The new business model integrates strategic programming at the global level, country level, and even operations level. The Figure below is a demonstration of this integrated approach.



FOREWORD

Dr. Bandar M. H. Hajjar

IsDB's 57 Member Countries include many of the fastest growing economies worldwide. Jointly, IsDB Members represent the purchasing power of almost one quarter of the world's population. The combined GDP of IsDB Members amounts to roughly USD 7 trillion. With GDP growth rates of up to 8% per year, the economies of IsDB's Member Countries have considerable potential to further increase their market share in the global economy.

IsDB has identified a set of core industries in which its Members offer distinct competitive advantages. **Agriculture** is one of them, and IsDB Member Countries have immense potential to be global leaders in cereal, horticulture and meat production and processing. Agriculture is recognized as a pathway for national transformation through socio-economic development and as a crucial engine for growth. However, the real value within agriculture in IsDB Member Countries remains largely untapped as IsDB members have concentrated on production. This has resulted in nascent primary and secondary processing in the region, and IsDB Member Countries are missing out on opportunities for higher value creation. At the same time, looming megatrends like climate change and population growth are fundamentally altering the competitive landscape and creating an urgency for IsDB Member Countries to increase efficiency and integrate into global value chains.

The coronavirus pandemic is displaying not only the crust of weaknesses in global supply of food but also the core questions revolving food security and access. Communities that were lifted from poverty are at higher risk of falling into poverty again, while the efficient production and supply of agri-food in different parts of the world are in the risk of collapsing. This calls for an even greater need for collaboration and adaptation to the "normal new". IsDB member countries need to understand their global positions in these complex Agri-Food value chains and collaborate in different areas to build resilience and future proof the industry.

Within its 10-Year Strategy, IsDB has set clear goals to catalyze private and public investment for the economic and social development of its Member Countries to the best possible extent. To sustainably drive modernization and growth, IsDB places strong partnerships between the private and public sectors at the core of its strategy.

IsDB aims to enhance the competitiveness of its Member Countries' agriculture sector, deepening and widening value chains domestically, exploring synergies between Member Countries, facilitating connectivity to the global markets, investing in science, technology and innovation, and leveraging global partnerships for knowledge and off-balance-sheet financing.

With the sector insights offered and the critical view on the challenges as well as the opportunities and potential ahead, this futures report provides a timely and valuable base line and starting point for future collaborations.

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EXPOSITION

The Year 2020 marks a key milestone for globalization forcing the world nations to make an important choice: “To Deglobalize” or “To Reglobalize”. In light of the expansion of protectionism globally, the steady increase in the population with at least 40 million young men and women annually entering the job market, and the acceleration of structural challenges as a result of the fourth industrial revolution and the Covid-19 pandemic, the world sits at a crossroad with major trade-offs to make.

This publication belongs to a series of publications that aim to create a feasible pathway for Reglobalization or the active evolution and reform of globalization by world leaders to make it more Resilient, Smart, and Inclusive. This book demonstrates, for instance, how resilience in Global Value Chains can be achieved while maintaining optimal efficiency. By capitalizing on the intrinsic comparative advantage of developing countries, global markets can have alternatives that are as efficient in times of crisis. This not only makes globalization more resilient but also inclusive of nations that have been left behind historically.

The Future is a series of publications, led by the IsDB Department of Strategy and Transformation (DoST), dedicated to forecasting economic trends, emerging global priorities, and helping Member Countries to be better prepared to meet them. The chief aim of the series is to help create global coalitions that are driven by a shared vision of the future of humanity and the world.

Dr. Ahmed Elkhodary
Director of Strategy and Transformation
Islamic Development Bank (IsDB)

EXECUTIVE SUMMARY

The agri-food sector is fundamental to many IsDB economies. The coronavirus pandemic has brought new set of challenges and reinforced the need to build resilient value chains in the future. By taking decisive unique and innovate actions, IsDB member countries can …

… generate additional agri-food exports worth USD 380 billion

… transform the labor market, improving qualification and income levels for 170 million people

… eradicate severe food insecurity for at least 40 million people

HOW WILL THE INDUSTRY LOOK LIKE WITH THE GLOBAL PANDEMIC?"

Four trends and challenges will profoundly impact the agri-food sector over the next decade: soaring food demand, shifting consumer preferences, resource depletion and rural exodus

- The coronavirus pandemic may trigger a push for more transparent and diversified value chains while accelerate the development and adoption of automation in agriculture production.
- Global population growth of some 800 million, heavily concentrated in IsDB countries, will significantly increase demand for food
- Rising incomes and urbanization will shift consumer preferences and nutritional habits, e.g. spurring demand for meat in emerging countries. At the same time, emerging consumer groups are turning to healthy, convenient, sustainably produced food and meat substitutes
- Unless decisive action is taken on innovation and more sustainable farming techniques, climate change and resource-depleting agricultural practices will hit IsDB countries hard, limiting output and putting food security at risk
- Shrinking economic opportunities will continue to fuel a steady rural exodus in many IsDB countries. To prevent lasting damage to their agri-food production potential, these economies need investment and innovation in the agri-food sector to provide young workforces with jobs and skills

AGRI-FOOD SECTOR – WHERE ARE WE NOW?

IsDB countries are copious agricultural producers, but many show a structural weakness in food processing, causing them to miss out on the most lucrative segments of the agri-food value chains. To respond effectively to global calls for sustainability and quality standards, the region's agri-business needs to transform itself

- Most IsDB countries emphasize production – which creates only 25-35% of an agri-food product's overall value – over processing, which adds 60-70%. Most of this value is added in developed markets
- Building a stronger food processing industry in IsDB countries is the key to obtaining higher global market shares and generating growth and employment
- At the same time, production and processing will need to become more resilient and resource-efficient along the

value chain. Agricultural output must increase, even as food losses are avoided and consumption of fertilizers and water is reduced

- International quality and food safety standards need to be applied in IsDB countries to cater to changing consumer needs and keep local producers competitive in export markets

- The creation of skilled jobs in the sector needs to be encouraged by mechanization, workforce education and improved infrastructure

HOW READY ARE IsDB COUNTRIES FOR THE FUTURE?

While some countries are real engines of the region's agri-food production, others need to ramp up efficiency and output to satisfy local demand and provide food security. Tailored approaches are required to develop the sector across all IsDB member countries

- **Productivity champions** among IsDB countries display high levels of agricultural productivity and are integrated into the global value chain. To sustain output and expand market share, they must invest in innovation and sustainability measures

- **Production-focused countries** have well-established agricultural sectors, but lack productivity, processing capabilities and adequate infrastructure. Building capacities for cost-efficient, high-quality food processing is key for these countries

- **Domestic market potentials,** the third group among IsDB countries, are heavily dependent on farm output, but their productivity and mechanization levels are too low to lift most farmers out of subsistence agriculture. To eliminate food insecurity and meet national demand, domestic market potentials need to invest in productivity and scale, which requires technology as well as workforce training

HOW TO UNLOCK THE POTENTIAL OF ISDB COUNTRIES IN A HIGHLY VOLATILE WORLD?"

Innovation and private sector involvement are crucial to improving the future competitive position of IsDB countries. Their agri-food sectors would be attractive to private investors with fair risk sharing and smarter allocation of capital

- The global agri-food industry has become a technology-driven, largely automated business in most developed economies, giving them a competitive advantage over IsDB countries that remain heavily dependent on manual labor

- With smart innovations based on digitalization, big data and AI becoming cheaper and more applicable to any farm size, IsDB farm producers have a chance to catch up with their more developed competitors

- Affordable low-tech innovations can boost resource efficiency and productivity. Modern drip irrigation systems can increase non-flooded rice yields by up to 30% while reducing water consumption by 50%

- The sheer size and growth of the IsDB countries' USD 650 billion agri-food market presents a unique opportunity for private investors. Promising approaches apply to the entire region, from mechanization and resource-efficient farming to high-value-added processing

- Unlocking private investment will require fair risk-sharing in large-scale projects, easier access to financing for smaller players, and the intelligent direction of knowledge and capital ("smart finance") to the sectors with highest potential. In addition, IsDB member countries can help their agri-food industries by promoting and localizing innovation through research funding and regional innovation hubs

KEY QUESTIONS TO BE ANSWERED BY THE PUBLICATION

How will the Industry look like with the Global Pandemic?

How will the agri-food sector change by 2030? – And how future-ready are IsDB's member countries?

How can public and private players work together for profitable sector growth in all IsDB countries?

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Drone monitoring a Malaysian oil palm plantation

Crop monitoring using infrared imaging allows targeted and thus more sustainable use of crop protection and fertilizers. Here, Genting Plantations Bhd. uses one of 20 SZ DJI Technology Co. Phantom 4 drones in Johore, Malaysia, to monitor about 160,000 hectares of oil palms in Indonesia and Malaysia

1

HOW WILL THE INDUSTRY LOOK LIKE WITH THE GLOBAL PANDEMIC?

The coronavirus pandemic is expected to streamline and reprioritize parts of the industry with greater emphasis on food security

The industry globally may accelerate the adoption and development of digitalization and the automation solutions especially in the advanced economies. This may pose a threat in production and processing which may significantly widen the productivity gap between the advanced economies and the developing and least developed countries. Rebuilding a resilient agri-food value chain will be of highest priority to IsDB member countries with significant emphasis on food security and sovereignty.

Many agri-food industries hold promise for IsDB member states

By applying modern technology and attracting more investment, IsDB countries can leverage their current position in plant- and meat-based industries to further boost value creation in the agri-food sector

Changing consumer needs are challenging current production profiles

Growing environmental and health awareness among consumers, as well as increasing demands for traceability of products, are forcing value chains to become more sustainable, resource-efficient and transparent. This offers greater scope for highly processed, high-value products

Industry advances could leave IsDB producers behind if they do not act

Genetic engineering, automation, digitalization, precision farming and sustainable innovations are some of the key technologies transforming agri-food value chains. To avoid being ousted by more productive global players, IsDB countries must step up their investments in R&D

Growing resource scarcity as well as rural exodus are heavily impacting the agri-food industry

IsDB member states are affected by water scarcity and soil depletion as well as workforce shortages due to increased urbanization – Changing farming practices and farmer education can ease these challenges

Sustainable and resource-efficient farming will be a game changer

The depletion of arable land is putting food security and competitiveness at risk in IsDB countries, even as climate change increases the frequency of crop failures. Investments in innovations will be crucial to increase sustainability and resilience

1.1

GLOBAL TRENDS AND THEIR IMPACT ON THE AGRI-FOOD SECTOR

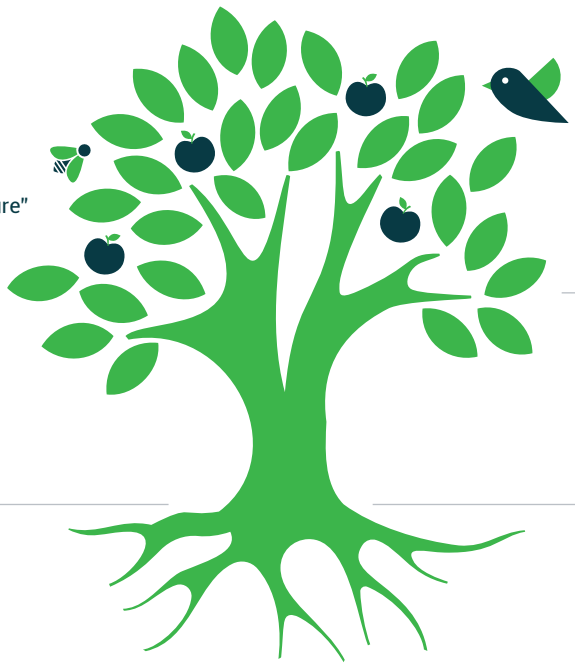
Megatrends, industry-specific trends, innovation

The coronavirus pandemic and the Great Lockdown since early 2020 have both caused an unprecedent-ed disruption and uncertainties in the global economy. The disruption in the supply and demand of agriculture and food industry is something that the world was never prepared to deal with. Population in IsDB member countries that suffered acute hunger in 2017 was around 64.5 million people while the annual food deficit stood at USD 67 billion (OIC, 2020). The risk of the coronavirus pandemic creeping into a global food crisis may threaten not only the lives of the most vulnerable population in IsDB member countries, but it would also probably double the number of people that suffer acute hunger.

Besides the most vulnerable population, the issue of food security and sovereignty is expected to be the priorities of most IsDB member countries during and after the pandem-ic. Disruptions in food supply chains as countries impose export controls and protectionist measures are beginning to inevitably drive up the price of staples. Although the price stability and inflationary pressures brought by food prices and staples in the short term might be an issue most IsDB member countries will be facing, the medium and long term requires countries to rethink and restrategize the supply of essential food for their population. This requires countries to build resilient agri-food value chains to first feed their population and relook the food security strate-gies in place.

Apart from the essential staples, IsDB member countries are also major exporters of certain agricultural commodi-ties such as palm oil and cocoa. As both these commodi-ties face price volatilities due to the pandemic and disrup-tions in the demand of certain food products, some export-ing countries and farmers may also lose income and might be at risk of falling into acute poverty.

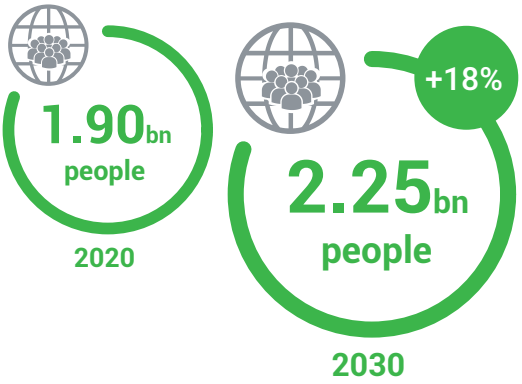
Trends shaping the agri-food industry



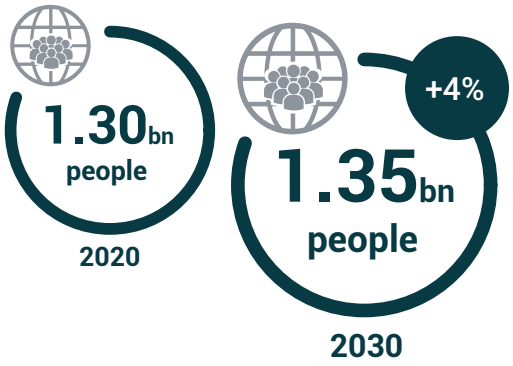
		IMPLICATIONS
Technology and business model innovation	• Genetic engineering • Mechanization & automation • Digitalization & big data • Alternative farming & "agritecture" • Regenerative farming	**Create concrete investment opportunities**
Industry-specific trends	• Regulations • Value chain integration	**Drive business strategy**
Megatrends	• Food demand • Consumer requirements • Resource depletion	**Set economic framework**

Population growth, 2020–2030

IsDB member countries



OECD countries



Development of food demand, 2010, 2030, 2050

The pandemic and lockdown have shown the world that agri-food industry like many other industries are interde-pendent in the complex value chains from input to output and the risks posed along the value chain requires countries and policymakers to take action in building a resilient agri-food value chain. Understanding the different stages and complexity of the value chains and innovative collaborative approach is required to ensure this.

Over the past decades, agri-food has started to turn into a highly tech-driven, automated industry. Key to feeding their populations and providing jobs in rural areas, agricultural production is fundamental to the economies of most of the Islamic Development Bank's 57 member countries. These nations have enormous potential as agri-food producers and consumers, as they are located in some of the world's most fertile and populous areas. To unlock this potential and to keep up with growing food demand, however, the agri-food industry will have to undergo a fundamental transformation by 2030. This transformation is mainly driven by three broadly diffused trends: surging food demand, rising consumer expectations and resource depletion. At the same time, industry-specific changes, along with technological and other innovations, can facilitate the required transformation. These issues will be addressed in chapter 1.2.

1.1

GROWING FOOD DEMAND

The world's population is expected to grow from 7.8billion to 8.6 billion people by 2030. More than 90% of this increase will come in emerging economies, led by Nigeria, Pakistan and Indonesia. In the coming decade, the populations of these and other **IsDB countries** will increase between **five and ten percentage points faster** than the global average, with 50% of overall growth coming in sub-Saharan Africa and 30% in Asia and Latin America.

The advent of some 800 million new mouths to feed will naturally drive up **demand for food.** To provide this growing population with an average of 3,050 kilocalories per person per day, a 25% increase in food calories (compared to 2010 levels) will be needed by 2030 and an even more substantial 56% increase will be required by 2050. To meet this challenge, the agri-food industry will be compelled to become radically more productive and efficient.

RISING CONSUMER EXPECTATIONS

Besides strong population growth, forecasts point to sustained expansion of the world economy, resulting in a global GDP increase of 34% by 2030. This is expected to translate into a worldwide enlargement of the middle class, with access to higher disposable incomes. At the same time, urbanization will continue, as more and more people move to cities in search of jobs and economic opportunity. By 2030, approximately 60% of the global population will be city dwellers, compared with 56% today. Urbanization rates will average between 81% in developed countries and 57% in the developing world.

Rising affluence and urbanization are causing **changes in consumer habits.** Observable sub-trends include a taste for convenience and fresh foods, as well as healthy eating, especially in North America and Europe. A growing number of consumers in wealthy countries are turning to meat-free and plant-based food. Start-ups like U.S.-based Beyond Meat are performing impressively, while the U.S. market for plant-based food expanded by 31% between 2017 and 2019. In Asia and Africa, on the other hand, the shift toward a more protein- and fat-rich diet will spur demand for animal products. Here, the agri-food sector is challenged to find and **develop new sources of protein** as conventional production of protein-rich feed is increasingly encountering the bottleneck of finite arable land and competition for land use from food and fuel production. This has sparked rapid growth in the market for innovative protein sources. Researchers around the world are developing feed products derived from insects, micro-algae, seaweed, legumes, mushrooms and nuts. Food safety is also becoming more important, in China as well as in Europe, as socially responsible consumers demand information about products and proof of sustainable cultivation.

To stay competitive, IsDB member countries will need to tailor their products to consumer tastes and adopt international quality and food safety standards. Even on the local level, production capacity and distribution networks will need to be scaled up to supply rural and fast growing urban areas.

RESOURCE DEPLETION

While food demand and consumer expectations are on the rise, the loss of fertile soils due to unsustainable farming methods and climate change is also expected to increase. Estimated annual losses of global food production due to water erosion account for 33.7 million tons. For Indonesia alone, annual losses account for more than 4 million tons.

Growing demand for land leads to increasing deforestation as farmers turn forests and grassland into arable land. However, deforestation leads to the loss of biodiversity and soil degradation.

Salinization and loss of organic matter due to overuse of pesticides further aggravate this trend. By 2025, the market for agrochemicals is expected to grow by more than 40% to USD 308 bn (compared to 2016 levels). These trends indicate that farming practices will further intensify, hence exacerbating the risk of soil degradation.

Building on past successes in environmental regulation (such as cocoa production certification in Côte d'Ivoire), IsDB countries need to broaden these safeguards while adopting sustainable farming methods (such as water-efficient irrigation and targeted use of fertilizers) to sustain the long-term vitality of their agri-food sectors. Investment to build up knowledge and infrastructure in these areas will yield tangible economic benefits.

Beyond the three global megatrends outlined above, several industry-specific trends will make themselves felt in the years ahead.

NEW REGULATIONS

Changes in the regulatory regime – many **relating to environmental concerns and the need for sustainability** – will impact the market. The Dutch government, for example, wants to achieve sustainable livestock production by 2023, reducing manure volumes in order to meet the EU's phosphate standards. Other regulatory initiatives will strive to protect biodiversity and/or impose restrictions on land and water use and genetically modified crops. These developments will primarily affect crop production and processing, helping prevent further resource depletion.

Aside from sustainability issues, import quotas are already affecting agri-food trade flows worldwide, shifting the competitive balance between regions and countries. Trade "wars" such as the present dispute between the USA and China harbor both risks and opportunities for the IsDB countries. The Chinese ban on imports of certain U.S. food products, for example, could benefit exporters from other nations as exports to China could to some extent be replaced by exports from IsDB countries.

VALUE CHAIN INTEGRATION

Companies try to lock in profits by covering more steps of the global value chain, extending into the production and primary processing of food. Traders, for example, are pushing into upstream and downstream segments to compensate for dwindling margins in their core business. Global players in the palm oil industry now control every link in the chain, from production to secondary processing. Similarly, vegetable oil producers are setting up refineries and bottling plants. **This pursuit of vertical integration** is designed to help companies add more value, obtain greater control of supply chains, or both.

For IsDB member countries, vertical integration offers the additional promise of generating more skilled jobs and boosting farmers' disposable income.

1.2

GAME-CHANGING INNOVATIONS AT A GLANCE

Key technological advances can boost IsDB countries' productivity

Agricultural technology has come a long way since hunter-gatherers in the Levant first scattered wheat and barley seeds in the hope of growing extra food 11,000 years ago. Innovation today covers every link in the global value chain, from production to processing and food delivery.

In most developed economies, agriculture has become a technology-driven, automated business. Some crops are genetically modified before planting to withstand pesticides and insect infestations, while the processes of sowing, watering, fertilizing and harvesting plants are mechanized and controlled using data in the cloud. Not so in less developed countries, however, where farmers still rely heavily on manual labor and the intensive use of pesticides. That leaves ample scope over the coming decade to introduce innovative technologies in the farm sectors of developing economies.

Beyond purely production-related innovations, upgrades will also come at the primary and secondary processing links in the value chain. In processing and food packaging, many initiatives are aimed at improving product sustainability and providing sustainable packaging. Looking even further ahead, it appears that technologies like 3D printing could be applied to the agri-food business – using hydrocolloids, for example, to print sustainable food.

The rest of this chapter focuses on five technology trends that will be crucial to agriculture in the years ahead.

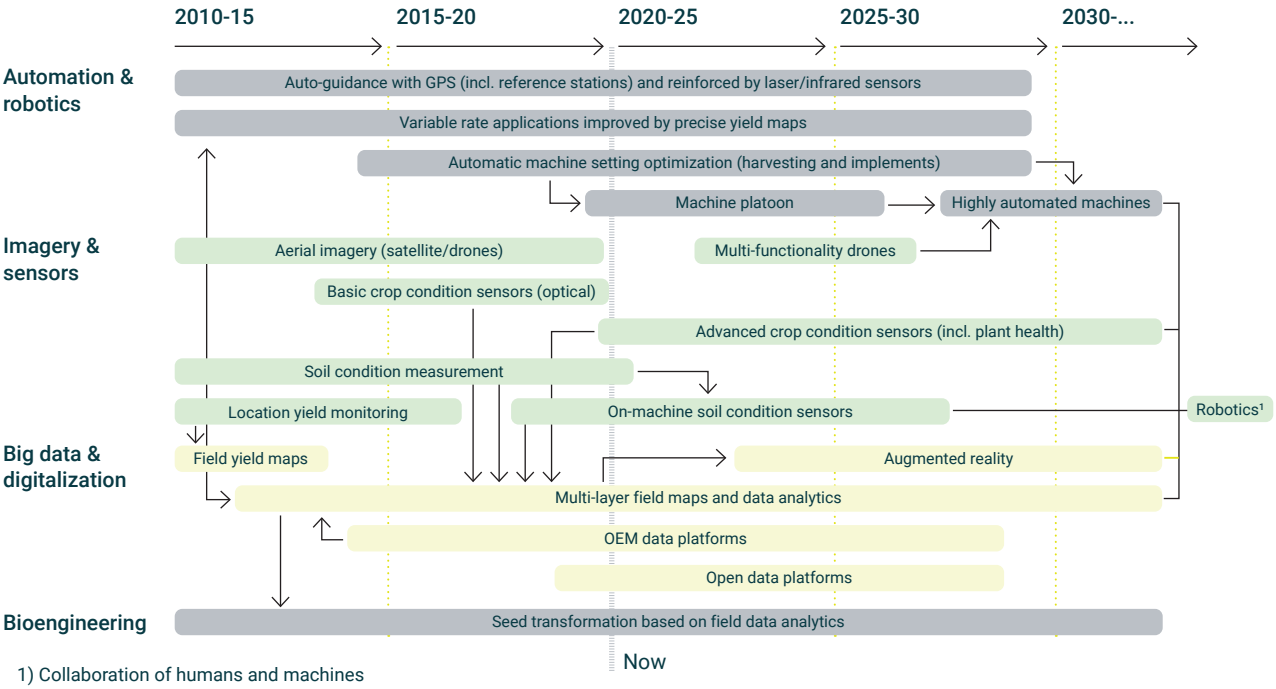
First, the better integration of **automated systems** can make a broad spectrum of farm operations more efficient and productive. Robots and autonomous vehicles are good examples of the potential afforded by such technologies.

The market readiness of different automated systems varies greatly. Some products like milking robots and automated feeding systems have already gained significant market share. Likewise, self-steering tractors, GPS-driven distribution of fertilizers and pesticides and automated mechanical weeding attachments have successfully penetrated the market.

It is important to remember that the use of heavy farm machinery is still limited in most IsDB member countries – especially in Africa, where small plots on broken terrain often make manual labor unavoidable. That said, some companies are working on smaller and more practical robots to access even difficult farmland. The next level will be robots, replacing man-driven machinery such as tractors. Robots will not only work autonomously, but could soon disrupt the market for agricultural machinery as they are light and affordable. This trend will be of particularly high relevance for IsDB countries, as it may involve much lower investment costs than conventional technology.

Second, **digitalization, big data and AI** will affect all levels of the food value chain. Smart and precision farming, which harness automated systems and big data, will optimize growth and improve yields, powering fast market expansion in the coming years. This trend is closely connected with automated systems. Exchange of data between different agricultural machines like harvesters, seeding machines and fertilizer sprayers is contributing to an efficient use of inputs. Increasing amounts of available data will lead to better and more resilient farming systems. Weather data will improve irrigation efficiency, soil data the precise application of fertilizers, market data the better conformity of supply and demand. In animal husbandry, data can contribute to better growth and to improved health and animal welfare, e.g. by individualized feeding strategies. Blockchain and similar applications will improve traceability and connectivity

Precision farming technology roadmap, 2010-2030



1) Collaboration of humans and machines

between market partners along the value chain. For small-scale farmers, this trend will become the most important one, as data-driven innovations tend to be affordable tools, often available as free mobile applications.

Genetic engineering – the third trend – alters a plant's existing DNA and has dominated technological development in the agricultural sector over the last two decades. The introduction of GMO crops, e.g. for cotton, maize and eggplants, has brought early successes in Bangladesh, Sudan and Pakistan, increasing yields, while diminishing the need for pesticides. Other IsDB countries are conducting research and plan to follow suit.

A predominant feature of currently available GMOs is resistance against certain pesticides and pests. For IsDB countries, drought-resistant plants or crops with improved nutritional value would also be of particular interest; however, these crops are not market-ready yet. Genetic engineering will continue to be an important plant breeding trend until 2030. At the same time, other technological trends demonstrate more innovative and disruptive chances for the agri-food sector.

Alternative farming methods – the fourth trend – have the potential to radically change the agri-food business. Hydroponic, aquaponic and aeroponic farming methods substitute mineral nutrient solutions in a water solvent for soil or use an air or mist environment.

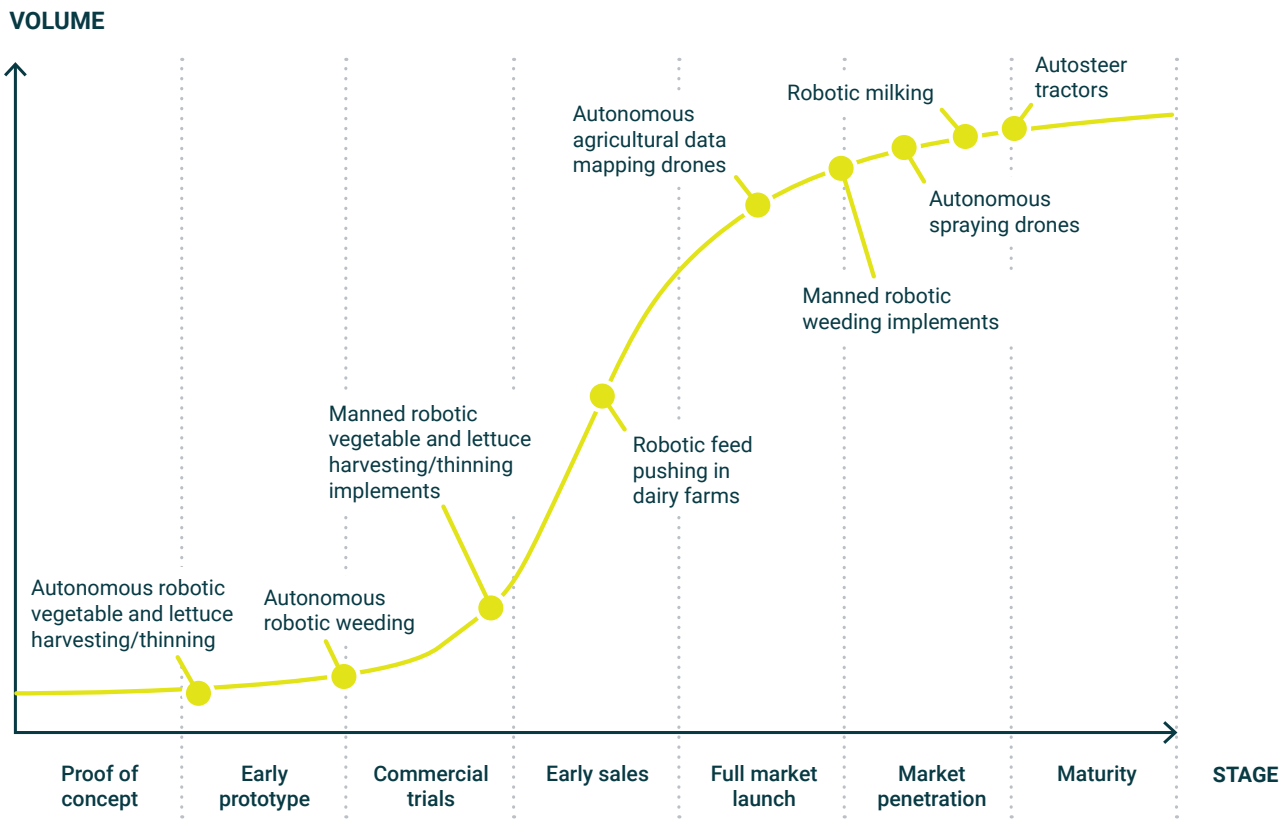
Vertical farming, as another example, grows crops in indoor stacks, replacing soil, daylight and rain with nutrients, artificial light and irrigation. Crops take up less space, are better protected and can be tended by robots.

The world's largest vertical farm – designed to produce 6,000 pounds of green leafy vegetables per day – is already operating in Dubai. Other IsDB countries with little arable farmland – notably Bahrain, Qatar and the UAE – could likewise benefit from this approach.

Lastly, **regenerative farming** employs principles and practices that can increase biodiversity and improve soil and groundwater. This includes waste-to-resource systems, more sustainable feedstock and the use of recycled water and materials. Examples include the recycling of animal and plant waste (for reuse as biofuels or fertilizers). Sustainable feedstock initiatives include the use of algae and gas-fed bacteria.

1.2

Market and technology readiness of agricultural vehicles and robots



One practical way for smallholders to access these innovations is through collaborative networks. By pooling resources, groups of farmers can use crop waste as animal feedstock and animal waste as fertilizer. However, research currently underway in sub-Saharan Africa suggests that careful negotiation is needed to get farmers to buy into this approach and achieve the critical mass needed for larger-scale recycling.

1.2

GAME-CHANGING INNOVATIONS AT A GLANCE

Three case studies on potential innovations and technologies for IsDB member countries

1 Virtual large-scale farming – GrowList

The efficiency and profitability of small-scale farming in IsDB member states is undermined by three main factors: weak and uncoordinated crop planning, limited market power vis-à-vis the trading and processing sector, and massive post-harvest food losses. For example, in sub-Saharan Africa, c.35% of the vegetable harvest is lost after harvest due to faulty storage or transportation delays, among other factors.

To counteract the first problem, crop planning tools harness big data and digital networks to integrate the agri-food value chain both vertically and horizontally, helping small-scale farmers work together to become more efficient. GrowList, funded by the German Federal Ministry of Agriculture, is one such pilot program, offering a software interface between individual farmers and big food processors.

HOW IT WORKS

Crop planning software is already helping farmers manage data and improve efficiency. Yet two missing links need to be filled to have a real market impact. The first is that crop planning and production should be demand-driven, especially when it comes to highly perishable produce. That requires integrating customers at the B-to-B level into the crop planning system, allowing them to order in advance and decide which and how many crops are grown. Second, to satisfy the demands of big customers, small farms must cooperate to make large and reliable deliveries. The best way to align production is through a shared crop planning system. By using the same platform, farmers can build virtual large-scale farms by aggregating many smaller plots.

ADVANTAGES AND LIMITATIONS

The main advantage of this approach is it allows farmers to produce on demand and deliver just-in-time. Storage is minimized, with a corresponding reduction in post-harvest wastage. The second advantage of "virtual" large-scale farms is that they can sell to larger customers, cutting out local intermediaries. Moreover, use of crop planning software helps farmers use inputs and services more efficiently. One limitation on the use of such software is the lack of internet access in some rural areas – however, many such applications are designed for smartphones, which do provide coverage in most rural areas.

RELEVANCE FOR IsDB

Agriculture in many IsDB member states is dominated by smallholders. To retain jobs and prevent depopulation of rural areas, it is essential to provide farmers with a decent living by improving their productivity and market access. Harnessing the power of data and digitalization can accomplish this at a relatively modest price.

1.2

2 Automated weed control – Robovator and See & Spray

Weeding is one of the most exhausting and time-consuming farm activities. Weeds can decimate yields but can normally be tamed only with hard manual labor or costly and damaging herbicides. Machines like "The Robovator" and the "See & Spray" aim to change all that. Both are precision-farming weed-control robots that use intelligent imaging to remove weeds and protect crops.

HOW IT WORKS

The Robovator is an automated hoeing system for mechanical weed control without herbicides. It is attached to a farm vehicle and pulled over several crop rows at the same time. Plant detection cameras track each row to maintain alignment and distinguish between crops and weeds, automatically lifting the hoeing tool when it detects a crop.

See & Spray is a system to minimize herbicide application by precisely targeting individual weeds instead of spraying the entire field. The technology relies mainly on digital imaging and machine learning. Other companies offer fully autonomous systems like Dino, the vegetable weeding robot from Switzerland's Naio Technologies, or Fendt's MARS concept (Mobile Agricultural Robot Swarms), which deploys groups of satellite-guided mini-robots for seeding and weeding.

ADVANTAGES AND LIMITATIONS

The obvious benefit of automation is saving time and labor costs. But the examples mentioned above offer many other advantages. Above all, they limit or completely eliminate the need for herbicides, which cuts costs and protects soil from damaging chemicals. Curbing the use of herbicides also means less harmful runoff, safeguarding local water supplies, flora and fauna. However, technologies such as Robovator still exhibit flaws. They sometimes have trouble distinguishing between rows of overlapping crops, or between crops and weeds of the same size. In this regard, the imaging and AI built into See & Spray machines provide more precision because they do not rely on spacing, color or size to identify weeds. The machines gather data on every plant they pass over, allowing the software to constantly refine its knowledge and fine-tune its effectiveness. However, these weeding systems are thus far only applicable for certain crops. Another barrier to use by small and medium-sized farmers is their high cost (a Robovator is priced between USD 120,000 and USD 175,000) and limited availability.

RELEVANCE FOR IsDB

Mechanical weed control is undoubtedly of considerable interest to IsDB member countries. The overuse of herbicides and fertilizers is a big issue throughout the region, and technologies like the Robovator and See & Spray offer a potential solution. However, price remains a factor. For now, the high capital costs of such technologies will likely put them beyond the reach of all but large operators.

3 Vertical farming – Techno Farm

Space is an important constraint in conventional farming. Plants need room to grow, requiring big fields, lots of heavy equipment, bulk logistics and exposure to all weathers. But what if crops could be grown in much smaller spaces, even under a roof, and be tended by robots rather than farmers?

This vision of so-called vertical farming is far from new, but it is now being taken to a different level. The Techno Farm concept introduced by Spread, the Japanese farming technology company, has become one of the industry leaders. It places lettuce farms in indoor factories, producing out-of-season vegetables in small amounts of space.

HOW IT WORKS

Instead of rows in fields, Techno Farm grows lettuce indoors in stacked layers, often without soil. The "natural" conditions plants need to grow – light, nutrients, water – are provided artificially and optimized by machine. Nutrients, for example, can be monitored and adjusted to maximize plant growth. The whole cultivation process is largely automated. Robotic arms transplant mature seedlings to new growing panels and robot cranes stack panels in cultivation racks according to their growth stage. Excess irrigation water and evaporation is automatically collected and recycled. Spread, which is based near Kyoto, has been building vertical farms since 2007 and gradually minimizing some of the drawbacks of the technology (such as high energy consumption). It currently operates at a national level.

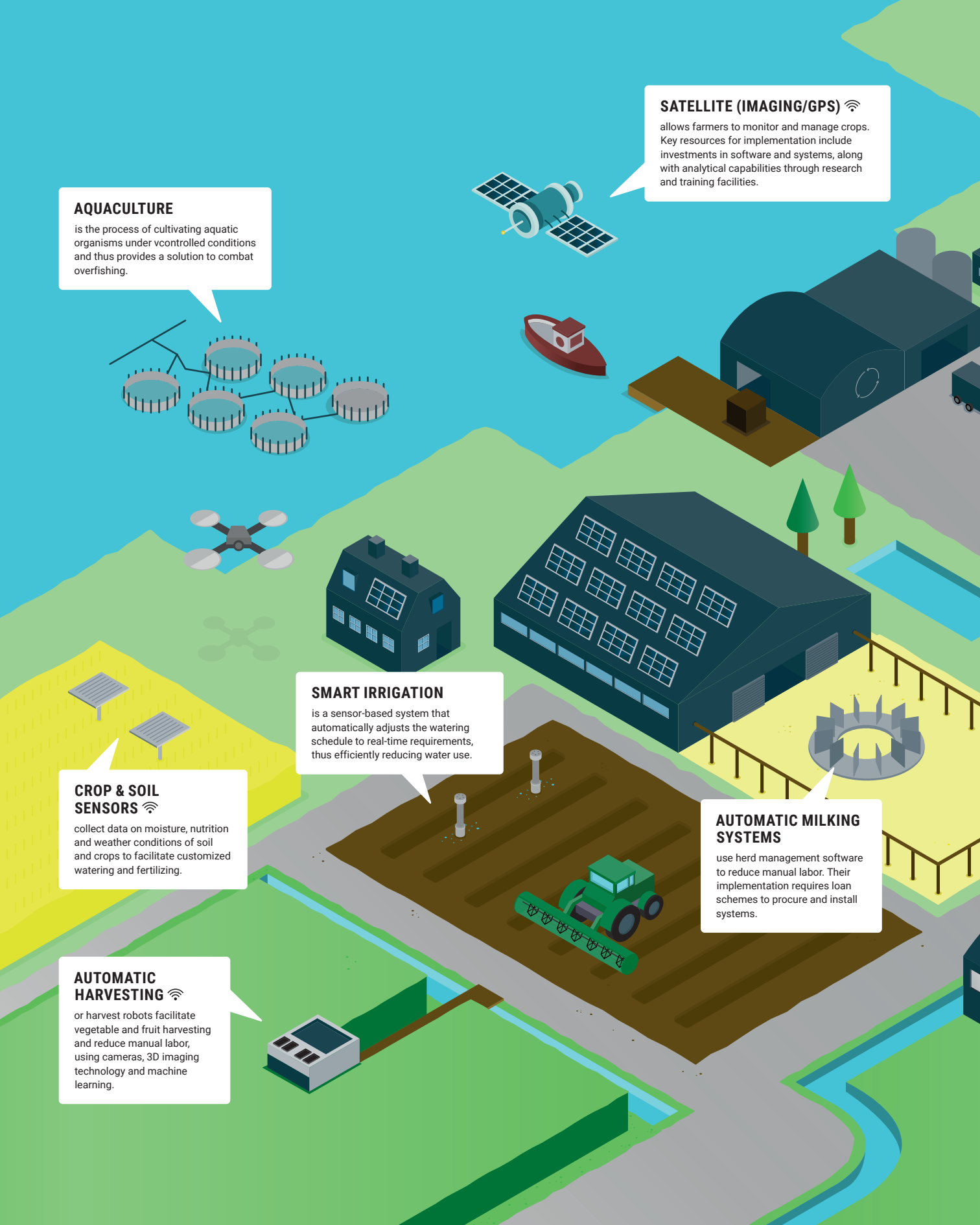
ADVANTAGES AND LIMITATIONS

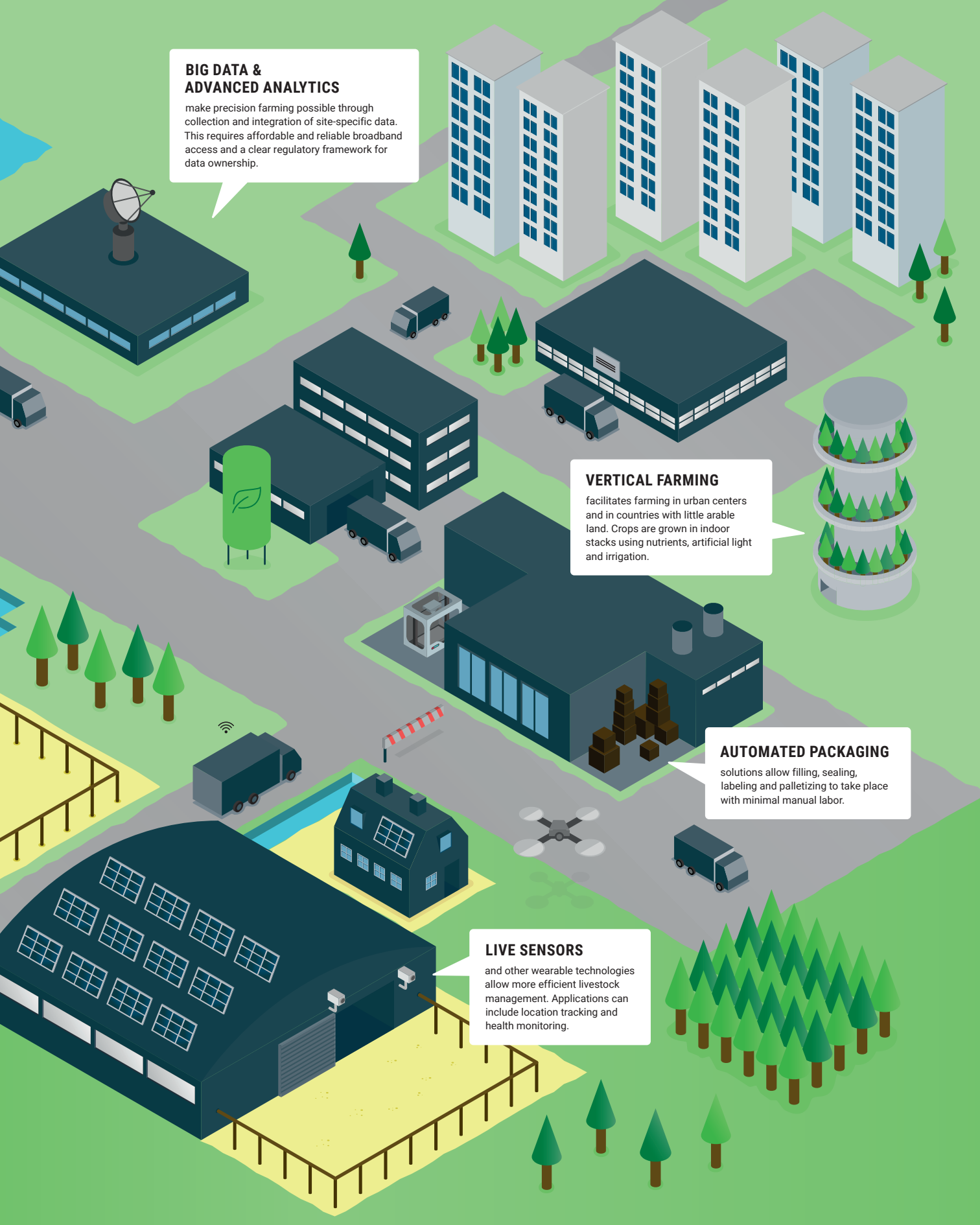
Among Techno Farm's multiple advantages is sustainability. The lower space requirements suit growing urban populations and neatly address the dwindling availability of arable land. In addition, farms can be climate controlled, water usage cut by 70-95% compared to outdoor farms, and yields improved by a factor of 50-100. The use of pesticides and herbicides is also eliminated, while automation reduces the need for human capital and makes farming jobs more attractive to the younger generation.

But labor savings and convenience also bring costs. Robotic equipment, heating and artificial light are expensive. As a result, Techno Farm lettuce must be priced in the premium wholesale segment. The system is currently only adapted to lettuce cultivation, and its methods are not cost efficient for bulk crops such as wheat or corn.

RELEVANCE FOR IsDB

While clearly a promising technology, vertical farming is still limited in its applications. The system is suitable for exotic crops needed in relatively small quantities, but needs upscaling and diversification before it can meet the requirements of IsDB member countries, which specialize mostly in bulk crops. High capital costs will also be a limiting factor. As a result, the widescale use of vertical farming is not envisaged among IsDB members in the near future. However, it remains an intriguing possibility for countries such as the Gulf states with limited arable land.


SATELLITE (IMAGING/GPS)
allows farmers to monitor and manage crops. Key resources for implementation include investments in software and systems, along with analytical capabilities through research and training facilities.
AQUACULTURE
is the process of cultivating aquatic organisms under vcontrolled conditions and thus provides a solution to combat overfishing.
SMART IRRIGATION
is a sensor-based system that automatically adjusts the watering schedule to real-time requirements, thus efficiently reducing water use.
CROP & SOIL SENSORS
collect data on moisture, nutrition and weather conditions of soil and crops to facilitate customized watering and fertilizing.
AUTOMATIC MILKING SYSTEMS
use herd management software to reduce manual labor. Their implementation requires loan schemes to procure and install systems.
AUTOMATIC HARVESTING
or harvest robots facilitate vegetable and fruit harvesting and reduce manual labor, using cameras, 3D imaging technology and machine learning.


BIG DATA &
ADVANCED ANALYTICS
make precision farming possible through collection and integration of site-specific data. This requires affordable and reliable broadband access and a clear regulatory framework for data ownership.
VERTICAL FARMING
facilitates farming in urban centers and in countries with little arable land. Crops are grown in indoor stacks using nutrients, artificial light and irrigation.
AUTOMATED PACKAGING
solutions allow filling, sealing, labeling and palletizing to take place with minimal manual labor.
LIVE SENSORS
and other wearable technologies allow more efficient livestock management. Applications can include location tracking and health monitoring.

1.3
KEY CHALLENGES AHEAD
Rural exodus, investment gaps and farmland degradation

By its very nature, agri-food faces a set of rather unique challenges compared with other sectors. This section explores three major issues.

RURAL EXODUS

First, IsDB countries are experiencing a nearly universal flight from the countryside. This exodus, typical in developing economies undergoing rapid urbanization, is driven by the differential between farm incomes and city wages, along with the hard working conditions and risky operating model inherent in a seasonal, highly volatile business like farming. Not surprisingly, these considerations have persuaded many farmers to migrate with their families to urban centers.

Meanwhile, output productivity has stagnated because farmers lack the capital to invest in technology, inputs and know-how. This further diminishes the farm sector's attractiveness to the next generation. The dwindling number of farmers, combined with low farm productivity, will likely result in food shortages and increase dependency on expensive imports.

Three main levers can help ease this labor shortage. Financial support and training can help farmers who remain on their land mechanize and automate. With less work needing to be done by hand, the requirement for manual labor will decline. Second, innovative farming technologies can boost productivity and help forge commercial links between town and country; indeed, the injection of technology and innovation into the agri-food industry will increase the sector's appeal to the tech- and data-minded younger generation. Lastly, encouraging farmers to negotiate collectively and form cooperatives will augment farm incomes, helping the sector retain and attract talent.

INVESTMENT GAPS

The second major challenge is investment gaps in agriculture. Rabobank has identified a USD 800 bn shortfall in cumulative investment in the Asian agri-food industry through 2030. Investors often shy away from farm projects because of tight margins compared to other industries and greater long-term risks, including weather- and climate-related volatility. These barriers to investment limit small farmers' capacity to adopt new technologies and innovation.

Three initiatives can help address these issues. Financial risk-sharing incentives such as trade credit insurance or investment guarantees can encourage private investment. Incentives for market consolidation and cooperatives can make it possible for small farmers to pool resources. And publicly funded investments in technologies that boost productivity could create a virtuous circle, generating income that allows farmers to buy new equipment.

FARMLAND DEGRADATION

The third challenge concerns farmland degradation. Increasing temperatures and water scarcity due to climate change and unsustainable production techniques are having a significant impact on farm output and the amount of available arable land. The UN estimates that each year 24 billion tons of fertile soil are degraded due to intensive farming.

Three potential solutions to address such problems were identified: First, investments in research and development of climate-resilient farming systems can help boost productivity. Second, farmers can be educated to use chemicals more efficiently. Third, IsDB member states can encourage organic farming techniques that increase biodiversity and plant resilience in the long term.

Irrigated green fields in an otherwise barren landscape in Saudi Arabia

Depletion of resources, e.g. water, could be further reduced by the application of efficient drip irrigation systems

1.3
KEY CHALLENGES AHEAD
Deep dive on food insecurity

FEED THE WORLD

When considering the key agricultural challenges of the future, food insecurity is a prime consideration. The UN defines food security as unfettered access to sufficient, safe and nutritious food that meets preferences and dietary needs for an active and healthy life. Conversely, food insecurity describes a prevalence of undernourishment, where food shortages are widespread and the calories consumed fall below minimum energy requirements. The UN Food and Agricultural Organization estimates that 2 billion people around the world are severely or moderately food insecure.

Food insecurity will persist in the future due to three underlying drivers. The first is climate change. Among the scientific community, it is widely accepted that the global climate is warming and that extreme weather events are becoming more frequent. The latter inflict enormous damage on the farm sector, ranging from rising levels of soil and water salinity to drought and land erosion.

The second driver is the aging rural population. Young people see no future in farming and are leaving rural areas to find work in towns and cities. The result is a lack of people to cultivate the land.

Finally, access to freshwater is becoming increasingly limited in many parts of the world, whether due to water shortages or contamination of the groundwater supply.

These developments affect food security in different ways in various parts of the world. This section takes a closer look at the situation in selected IsDB regions.

The main threat to food security in Africa is conflict

AFRICA

Despite its growing wealth, the food security situation in Africa appears to be worsening. This can be attributed to two key causes. Number one among them is conflict. Wars, uprisings, rebellions and insurgencies continue to blight the continent, but need to be resolved before food security can be established. Local conflict hinders agricultural output because it displaces the workforce and disrupts transportation of goods for processing and consumption. In addition, investment in the agri-food sector is often deferred as international donors focus on humanitarian efforts and risk-averse private players divert their investments to countries with more stable conditions. Second, Africa is particularly exposed to adverse climate conditions, such as droughts and flooding that decrease or destroy agricultural yields, especially in the continent's south and east.

Policy checklist:

- **Stabilize governance:** Respect for the rule of law, increased accountability and better regulation will provide protections that encourage investment
- **Invest and train:** Prioritize spending on proven innovative technologies and vocational training to increase crop resilience and build infrastructure mitigating the effects of natural disasters (e.g. dams, rainwater basins)

Population growth undermines food security in Asia

ASIA

Asia's main food insecurity problem is the rising population – domestic food production simply cannot keep up with growing demand. Building supply chains robust enough to get food where it is most needed in sufficient amounts also represents a significant hurdle, since complicated logistics such as cold chains are often absent in rural areas. Inadequate water resources pose another problem, as highlighted by the situation in Bangladesh – where up to a quarter of the groundwater is at risk from arsenic and saline contamination. A future concern could be the diminishing availability of arable land, as fertile soils are lost to overuse of pesticides and fertilizers, as well as adverse climate conditions.

Policy checklist:

- **Equip and train:** Dissemination of knowledge about sustainable and resource-efficient farming as well as technologies
- **Innovate:** Investments in productivity-enhancing technologies and alternative urban farming to boost agricultural output
- **Finance:** Investments in improved supply chain infrastructure such as cool chains and transportation networks

The MENA region's key constraint is lack of arable land

MENA

Already beset with strong population growth, the MENA region faces diverse food security challenges. The main problem is a shortage of farmland and water, since arable land accounts for less than 5% of the total territory in many of the region's countries, where desert terrain predominates. This makes the region highly dependent on food imports. A second challenge is upgrading supply chain infrastructure to supply a rapidly growing population. The third and most obvious cause of regional food insecurity is armed conflict and political instability in countries like Iraq, Libya, Sudan, Syria and Yemen, which adversely affect food production and distribution.

Policy checklist:

- **Finance:** Agri-food output in IsDB member countries with ample arable land should be increased by investing in production facilities and supply chains
- **Innovate:** In land-poor IsDB countries, alternative farming methods and anti-desertification programs should be introduced, with the aim of integrating agricultural production with urban centers

A coffee farmer in Eastern Africa with a moisture device, testing the quality of his coffee beans

Basic technology enables quality assurance and reduction of food losses along the value chain

2

AGRI-FOOD SECTOR – WHERE ARE WE NOW?

Agriculture remains the backbone of IsDB member countries in the years to come

Agriculture contributes in large part to the GDP of IsDB member states – As food demand will only increase further, IsDB countries should continue to invest in agri-food sector development

Agri-food demand is rising sharply across the globe and requires significant efficiency improvements

An expected 800 million increase in the world's population by 2030, with many IsDB countries being heavily affected, requires the agri-food sector to raise its production output to avoid food scarcity in the future

Untapped potential exists in production capacities of IsDB countries

IsDB member states are losing out on value creation through massive food wastage along the value chain. However, this also means that infrastructure investments, better farm management and education of smallholders can significantly boost agricultural output

IsDB member states can boost their value creation by expanding food processing activities

IsDB countries currently have a limited presence in food processing – However, primary and secondary processing offer opportunities for higher value creation in many industries

Value chain integration and stricter regulations will increase pressure on IsDB countries

Global players will gain further strength through integration along the value chain, resulting in greater control and higher margins – In addition, regulation, e.g. on CO_2 emissions, is increasing production costs

Some of the main crops grown in IsDB countries, such as palm oil and rice, are facing major concerns over the environmental impact of current farming practices and require transformation in order to stay competitive in the market

2.1

IMPORTANCE OF THE AGRI-FOOD SECTOR

Impact on economy, employment, investment and environment

Besides its obvious role in feeding humankind, agri-food has evolved into a diverse global sector whose operations range from farming to secondary processing, from small subsistence holdings to large multinationals. As such, it is a major factor in the overall economy, employment, investment and the environment. It also plays a key role in achieving several of the United Nations' Sustainable Development Goals (SDGs), from the fight against poverty and hunger to the demand for decent work and economic growth, but also – in the case of dairy farming, for example – to boost gender diversity and equality.

Agri-food contributed an impressive **USD 650 bn to the GDP** of the **57 IsDB member countries** in 2018. In some of the region's smaller economies, it accounted for as much as 57% of GDP (Guinea-Bissau) and up to 71% of total employment (Djibouti), though both figures are lower for more advanced countries with diversified economies (such as Turkey). In total, IsDB member states currently account for almost a quarter of the world's population, 9% of its GDP and 21% of the gross value add in agriculture.

However, with the **global population projected to rise** from 7.6 billion today to 8.6 billion in 2030 and **9.8 billion in 2050,** it is vital to further increase agri-food output in order to avoid the **threat of food scarcity.** Especially in sub-Saharan Africa, the number of undernourished people has recently begun to edge up again: Current projections thus indicate that available calories must increase by about 1.5% p.a. to curb world hunger by 2050. And perhaps the greatest challenge is to do this **sustainably.**

Key indicators, IsDB vs. rest of the world

Mechanization, automation, improved fertilizers and livestock feeds and farmer specialization are proven ways to raise **productivity.** However, greater investment and deeper knowledge are needed to enable IsDB member states to exploit this potential and reap significant benefits.

Another case for efficiency improvement is the **minimization of food losses.** Food losses along the value chain occur in many IsDB countries. According to the FAO, significant losses occur at all levels of the value chain, from on-farm post-harvest losses, storage and transportation to processing, packaging, wholesale and retail. While losses vary widely between regions and commodities, they heavily impact farm incomes and efficiency both in sub-Saharan Africa and in Southeast Asia. **Losses of 10 to 35% testify to the substantial potential for improvement** of farm income and efficiency at all levels of the value chain. At farm level, the lack of knowledge, alongside the distance to market and missing input factors are key reasons for food losses. In the subsequent value chain levels, the absence of adequate infrastructure such as cooling, storage and transportation capacities are what cause most food losses. Investments along the value chain could therefore strengthen the agri-food sector and improve food security significantly.

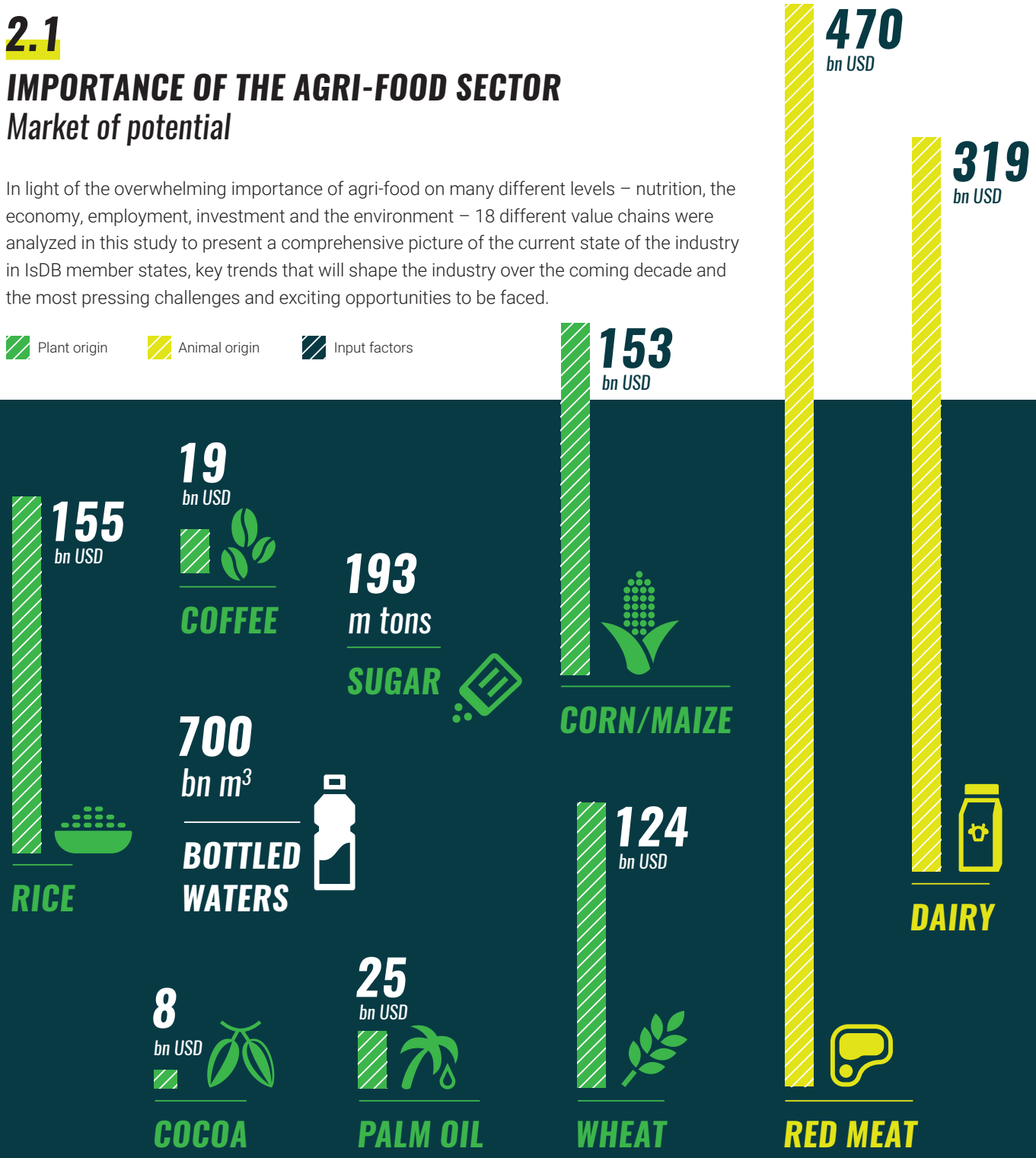
The potential for raising food output – given commensurate investment, technological advances and sustainable farming methods – is therefore self-evident.

This report focuses on **18 core industries** in the agri-food sector. Of these core industries, seven are **plant-based** (cocoa, coffee, maize, palm oil, rice, sugar and wheat), five are **animal-based** (dairy, fish, pet food, poultry and red meat) and six cover key **input factors** (agricultural equipment, (bottled) water, crop protection, fertilizer, irrigation equipment and livestock feed). The industries selected are representative of the sector as a whole. But they also illustrate the most pressing challenges, the most exciting opportunities and the key trends that will shape the agri-food sector over the coming decade.

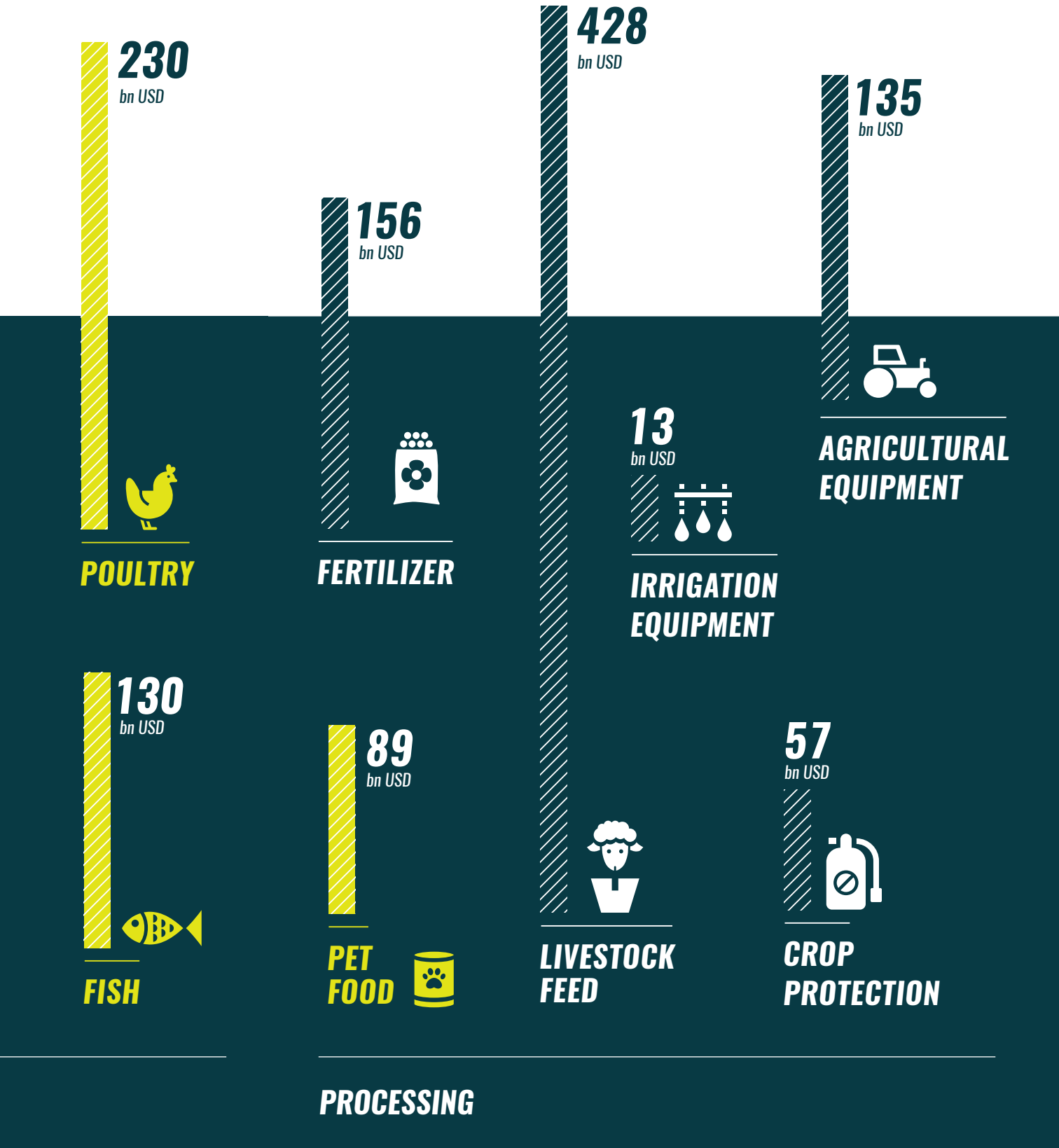
IsDB members occupy a dominant position in several plant-based industries and a strong position in three of the five animal-based industries, but have a much smaller footprint in input factor industries. All of the industries concerned have nevertheless been growing over the past five years and exhibit further upside potential. Given the right support, knowledge and investment, IsDB countries can therefore play an important role in increasing value creation in this strategically vital industry over the next decade and beyond.

2.1
IMPORTANCE OF THE AGRI-FOOD SECTOR
Market of potential

In light of the overwhelming importance of agri-food on many different levels – nutrition, the economy, employment, investment and the environment – 18 different value chains were analyzed in this study to present a comprehensive picture of the current state of the industry in IsDB member states, key trends that will shape the industry over the coming decade and the most pressing challenges and exciting opportunities to be faced.



PRODUCTION The depicted values show the global production/extraction market values; for pet food and input factors the values shown represent the global market value after processing.


230
bn USD
POULTRY
156
bn USD
FERTILIZER
428
bn USD
LIVESTOCK FEED
13
bn USD
IRRIGATION EQUIPMENT
135
bn USD
AGRICULTURAL EQUIPMENT
130
bn USD
FISH
89
bn USD
PET FOOD
57
bn USD
CROP PROTECTION
PROCESSING

2.2

IsDB COUNTRIES' CURRENT POSITIONING

Agri-food production is the key strength of IsDB member countries

IsDB member countries are located in some of the world's most fertile regions, providing both staple goods as well as everyday luxuries such as coffee and chocolate to consumers around the world.

Due to heterogeneous geographical locations as well as diverse soil characteristics, IsDB countries have managed to create **competitive niches,** leading to limited competition between members. For example, Côte d'Ivoire is the world's top producer of cocoa, responsible for around 40% of global production, whereas, when it comes to coffee, Indonesia is the world's fourth-biggest producer, and Uganda ranks tenth. In the palm oil sector, Indonesia is the number one producer followed by Malaysia. Together, the two countries account for around 85% of global production. Indonesia is also a leader in aquaculture, ranking second in terms of global production.

Exceptions to these specialized product portfolios are the dairy and meat value chains, where most member countries are active to cater to domestic demand.

Whereas production is largely focused on IsDB member countries, the value chain of agri-food products, from sowing to consumption, often spans the entire globe. While IsDB member countries exhibit **clear strengths in production** and sometimes also cover the associated preprocessing stage, they are often much weaker in the later stages of the value chain, especially secondary processing. Yet the **processing steps represent the stage with higher value creation,** accounting for up to 70% of the value of the agri-food sector.

For instance, despite Côte d'Ivoire being the world's biggest producer of cocoa, it has very **limited capability when it comes to secondary processing.** The majority of its beans are exported and processed in regions geographically close to where they are consumed – meaning Côte d'Ivoire misses out on the more profitable stage of the value chain, which makes up more than 90% of the value add.

The main barriers for IsDB member countries' integration into the processing steps of the value chain are **high investment requirements** for machinery and innovation as well as the level of **processing efficiency**, which often is significantly lower compared to global market leaders.

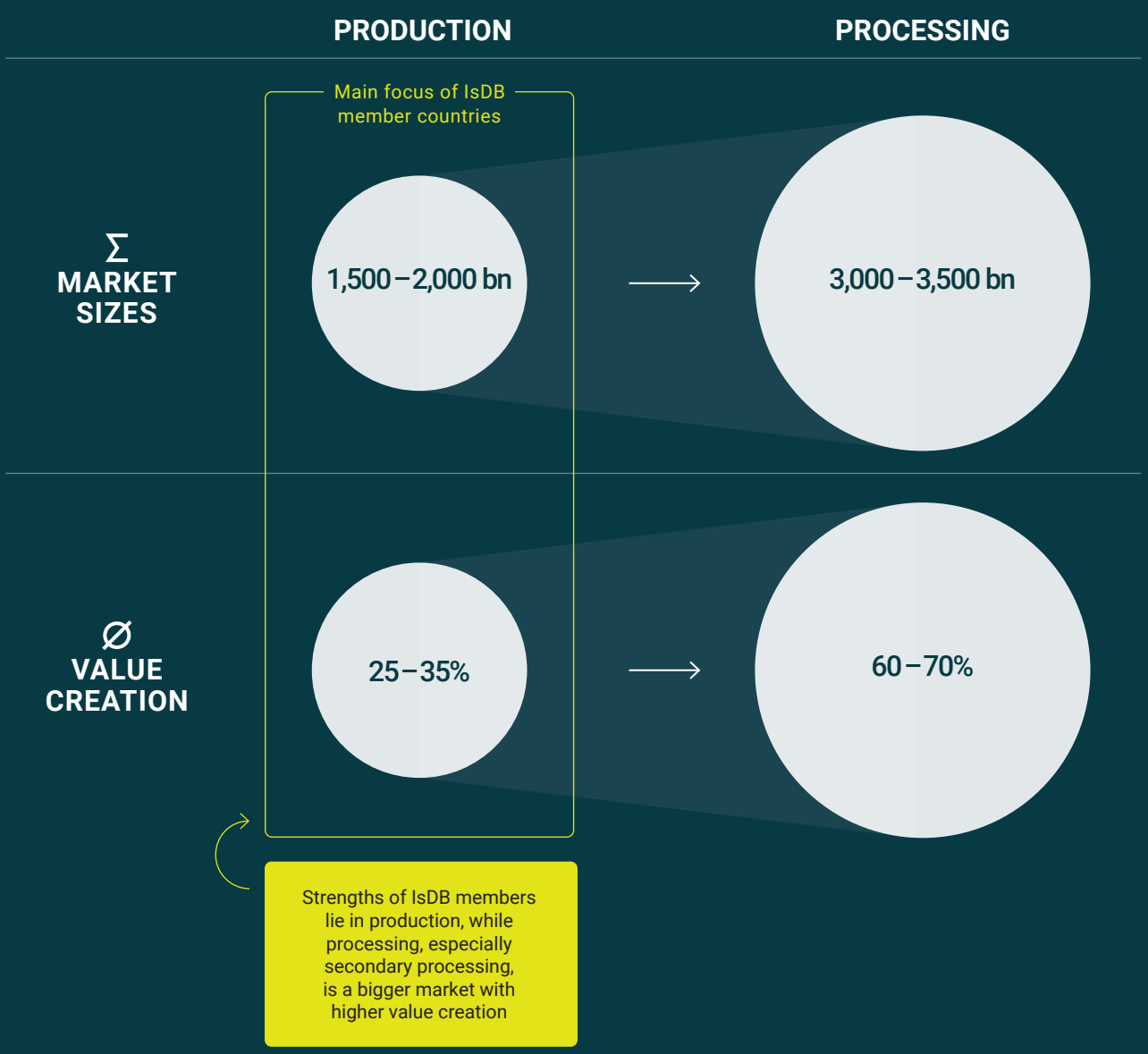
What does this mean for IsDB member countries and those looking to invest in them?

The agri-food sectors in IsDB member countries create **multiple attractive investment opportunities** – not only are many IsDB member countries real engines of production, but they also offer access to markets that represent almost a quarter of the world's population. There is a clear need to further strengthen and integrate the agri-food sector across all member countries in order to foster growth, value creation and employment.

Investments have to be tailored to the current strengths as well as local requirements of IsDB countries individually. For example, countries like Indonesia consistently generate high output and provide good opportunities for investments to further strengthen secondary processing, thus creating high value add. On the other side of the coin, countries like Somalia can profit most from investments in vocational training and mechanization to boost production levels for domestic supply, thus facilitating access to fast growing markets.

Snapshot of global industries[1]

1) As depicted on pages 34/35; not including sugar and bottled waters



2.3

INSIGHTS INTO AGRI-FOOD INDUSTRIES

From production to processing and retailing

Value chains indicate how various "input factors" are transformed and combined through different steps to create finished products. They comprise stages such as selecting input factors, production/extraction, primary processing and secondary processing. Trading and logistics occur at various stages within the value chain.

Generally, the first stage of the value chain is the selection of **input factors** 1. These include primarily seeds, fertilizers and feed. When it comes to agriculture, there are internal and external inputs to be distinguished between. Inputs produced on-farm are feed like grain, hay or silage, manure as fertilizer and seeds from the farmers' own harvest. External inputs include, for example, high-protein feed from soy, high-performance seeds, pesticides, mineral fertilizers, as well as agricultural machinery and fuel. In technologically advanced systems, software may also be an input factor. Input factors can either be produced by the farmers themselves, e.g. seeds and fertilizer, or be bought commercially.

The next step in the chain is the actual agricultural **production** 2. Here, the input factors are used to create the next stage of the product – usually a semi-finished good that needs further processing to turn it into a finished product. For crops, the production stage involves growing the actual plant, while for livestock it means raising the animals. In the case of equipment, crop protection and pet-food manufacturing, production means assembling or mixing the correct input factors.

The production stage is followed by **primary processing** 3. For crops and livestock, this involves taking the plant or animal and extracting the parts of them required for further processing. That could be cleaning and drying fruit or slaughtering, cutting and deboning animals. For feed and crop protection this represents the final step, involving blending, processing and packaging to arrive at the finished product. Similarly, for equipment this is the final step, involving assembling the parts into finished products that can be distributed. By contrast, crops and livestock are subject to **secondary processing** 4, transforming them into food products and packaging them for distribution.

The value chain analysis also identifies the **most relevant product categories** 5. Here, the percentage of the total market is estimated, represented by each of the finished products.

Trading 6 occurs throughout the value chain. Some countries specialize in a single step of the value chain and are dependent on input from an early stage. This is often the case with coffee, for instance, where the beans are grown in one country and processed in another. **Logistics** 6, for moving the commodities between the different steps in the value chain, is also generally handled by traders.

Finally, the **market size** of each industry is highlighted 7. This refers to the revenue of the production/extraction stage and the processing stages each taken individually. Of course, the market size in itself says nothing about the profitability of each stage, which varies significantly.

The above description is a somewhat simplified model, of course. In practice, the value chains for specific goods are interwoven, complex structures that can include other intermediate steps not shown in the illustration. Some examples of key industries will be presented in the following.

The detailed analysis of global value chains provides an understanding of the status quo of IsDB member countries' current positioning and offers insights into where additional value can be created in the future.

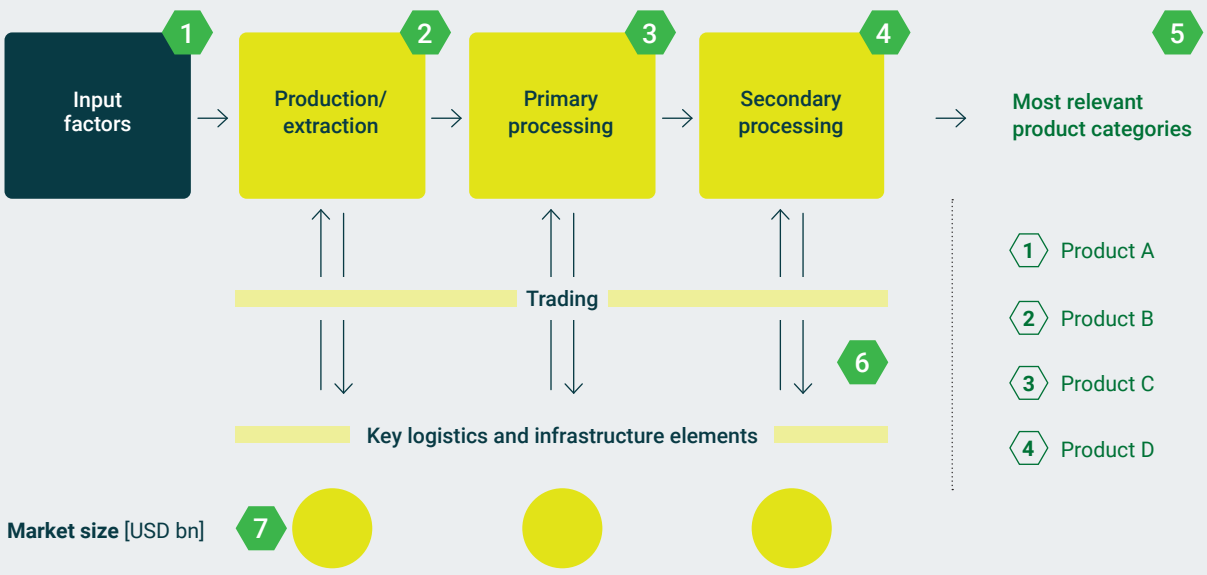
Crucial questions that need answering:

Which segments of each value chain show the greatest growth potential?

What trends are driving global demand and shaping the industry?

How can IsDB countries position themselves to unlock the most value?

Global value chain overview



2.3
INSIGHTS INTO AGRI-FOOD INDUSTRIES
Cocoa, palm oil, rice, fish, poultry

As outlined in section 2.1, the IsDB has identified **18 core industries** as a basis for analyzing potential opportunities and challenges in the agri-food sector. Within this group, five industries were deemed of particular interest to IsDB countries: **cocoa, palm oil, rice, fish and poultry**. For each industry, the global value chain was scrutinized, the positioning of member countries outlined, and development opportunities highlighted.

The five were chosen for different reasons: In **cocoa,** the IsDB countries' dominant position as producers lends the industry a special importance. Member countries account for two-thirds of the world's cocoa bean crop and boast four of the top five producers: Côte d'Ivoire, Indonesia, Nigeria and Cameroon. From their position of strength in production and primary processing, member states have tremendous potential to collaborate across various links in the value chain – even in secondary processing, where they are still under-represented.

The **palm oil** industry harbors vast growth potential between now and 2030. Indonesia and Malaysia, the top two producers, indicate the IsDB's leading position in the global market. To remain viable, however, the industry needs to break with unsustainable methods of cultivation. Embracing initiatives such as the RSPO (Roundtable of Sustainable Palm Oil) would give IsDB countries a chance to retain and extend their hold on the market.

As a staple crop, **rice** – a key source of both nutrition and employment in IsDB member countries – is definitely worth a closer look. Against a backdrop of growing water scarcity, the potential for disruptive innovations such as aerobic rice cultivation is currently being examined.

Indonesia is already the world's second-largest **fish** producer. Yet the rise of aquaculture and new technologies that will disrupt existing market dynamics and improve sustainability suggest that other IsDB countries, too, should take an interest.

With increasing local demand, **poultry** production in IsDB member countries shows high potential for growth. One Saudi Arabian player ranks eleventh in the line-up of global top producers. New consumption trends will influence especially the processing steps as demand for processed ready-to-eat or ready-to-heat poultry products increases.

2.3

COCOA

- **IsDB countries produce nearly two-thirds of the world's cocoa beans and are strong in primary processing**
- **This well-established position could be bolstered by stepping up collaboration in secondary processing and mastering sustainability challenges**
- **As demand keeps growing through 2030, the cocoa industry will focus on boosting productivity and introducing more sustainable farming practices by adopting innovations such as drip irrigation**

2030 AND BEYOND – VERTICAL INTEGRATION, SUSTAINABILITY, FAIR TRADE

The cocoa industry is becoming more vertically integrated as bean-sourcing firms add chocolate products to their portfolios. Global trader Olam, for example, recently spent USD 75 m on a new 75,000-ton cocoa processing facility in Côte d'Ivoire. This trend will continue – down to the farm level in some cases. Vertical integration will also promote a second trend that can already be observed for many agricultural commodities: sustainability. Under pressure from consumers and regulators, global players are using their control of the entire value chain to improve its environmental and social footprint. In 2018, Mars Wrigley Confectionery launched its "Cocoa for Generations" program, backed by a USD 1 bn investment. The program addresses deforestation, child labor and farmers' incomes. Mars wants to get 100% of its cocoa labeled under its Responsible Cocoa program by 2025. This approach is freely applicable to other agricultural markets. "Bean-to-bar" is just another example of value chain integration that not only maximizes added value upstream but also translates the market's demand for more sustainability into downstream improvements. At the same time, vertical integration makes traceability and labeling easier and more credible.

The success of start-ups like Indonesia's Pipiltin Cocoa, which applies the "bean-to-bar" concept and offers consumers full transparency along the entire value chain, shows the growing effectiveness of such strategies in the cocoa market.

CHALLENGES – ETHICAL AND ENVIRONMENTAL SUSTAINABILITY

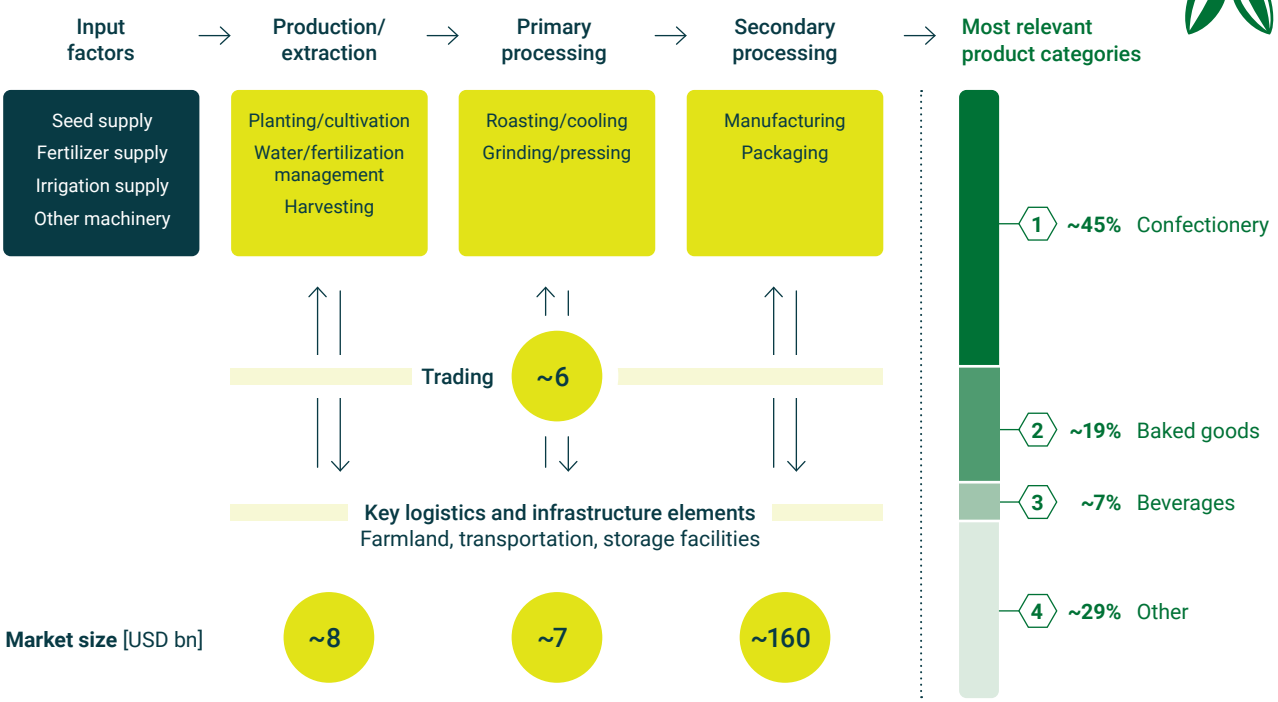
Decent working conditions for farmers are a major ethical (and economic) issue that must be addressed by the entire industry. An estimated 2.1 million children work in the cocoa fields of Côte d'Ivoire and Ghana alone. Volatile prices leave many small farmers at the mercy of market dynamics over which they have no control. Responsible production is another aspect of sustainability. Rising demand has led to extensive deforestation in many cocoa-producing countries. Degradation of soils and entire ecosystems could spur even more supply volatility in the future.

On these human and environmental issues, a global system of independently certifying ethical businesses is gaining ground. By recognizing cocoa producers that offer fair working conditions to farmers and commit to sustainable cultivation, third-party groups such as Fairtrade and UTZ are striving to put the cocoa industry on a more solid footing for the long term. Well-received by producers and consumers, these certifications will increase pressure on non-certified suppliers.

POSITION OF IsDB COUNTRIES – CONSOLIDATING STRENGTHS, OVERCOMING WEAKNESSES

IsDB countries boast four of the top five cocoa bean producers: Côte d'Ivoire, Indonesia, Nigeria and Cameroon.

COCOA | Global value chain overview



Compound annual growth of 1.8% is expected in global cocoa bean production through 2030. In Asia Pacific, demand for confectionery is growing fast enough to offset slacker demand in North America and Western Europe.

Cocoa production has a very sharp geographical focus: The IsDB countries Côte d'Ivoire, Ghana and Nigeria supply roughly two thirds of global production output. There is substantial intra-IsDB member country bean trade flow and IsDB members hold a significant share in the primary processing as c.36% of the global cocoa butter, c.41% of paste and c.24% of powder is produced and exported from IsDB countries. Conversely, around two thirds of secondary processing takes place in Europe close to consumption – a market in which IsDB countries still have room for improvement. While Pladis Global, a snack manufacturer owned by Turkish Yıldız Holding, is one of the top 10 global players in secondary processing, most other IsDB member countries are solely focused on production and primary processing.

They also have an established primary processing footprint. As most secondary processors are based in Europe, close to traditional consumer markets, this poses an opportunity for IsDB member countries to position themselves as secondary processors for the Asia-Pacific region, where demand has been expanding at a compound annual rate of 3.2% over the last six years.

IsDB cocoa producers should aim to consolidate their production and trading strengths, add to their primary processing expertise and raise productivity to keep competitors at bay. Following the lead of Pladis Global, they must also gain a foothold in secondary processing to complement their early-stage dominance. Here, they can leverage knowledge and investment from existing global players.

To attract such investment and bolster their competitive position, however, IsDB members should tackle the issues of ethical and environmental sustainability. One path is to embrace production origin certifications such as UTZ. In addition, independent agencies can be introduced to monitor issues such as deforestation, making use of modern drone and sensor monitoring.

2.3

PALM OIL

- **Palm oil sales are expected to nearly quadruple by 2030, driven by the food industry**
- **IsDB countries are dominant in global production and strong in primary processing**
- **Building up secondary processing and sustainability initiatives should be a priority for IsDB producers**

2030 AND BEYOND – FRESH INITIATIVES AND POTENTIAL ALTERNATIVES

As the world's most abundant and affordable plant-based fat, palm oil will remain an indispensable ingredient for food, cosmetics and other products. Even so, burgeoning demand is confronting producers with serious environmental challenges. Malaysia and Indonesia have taken the lead in seeking to promote sustainable production while protecting their economic interests.

Two clear trends can be observed. First, secondary processing companies are increasingly taking advantage of vertical integration to improve the quality and sustainability of raw materials output. Unilever, for example, has launched a Palm Oil Field School in Indonesia to train farmers in sustainable cultivation. In another initiative, Unilever, Nestlé and PepsiCo have joined other companies in a coalition to fund the development of a new radar-based forest monitoring system to detect deforestation. Value chain integration, meanwhile, is being used not just for cost reduction, but for quality improvement.

Another trend is the development of palm oil substitutes. In response to growing consumer concern at the destruction of tropical rainforests to make way for palm oil plantations, which led to the European Union's decision to ban palm oil's use as a biofuel, big players and start-ups alike are working on alternatives. ExxonMobil, for example, is developing an algae-based product. Coffee grounds, fungi and yeast are other substances under investigation as possible substitutes to palm oil. None are viable yet, however. At least for the next decade, producers of sustainable palm oil will be best positioned to meet growing demand, even as alternative sources begin to emerge.

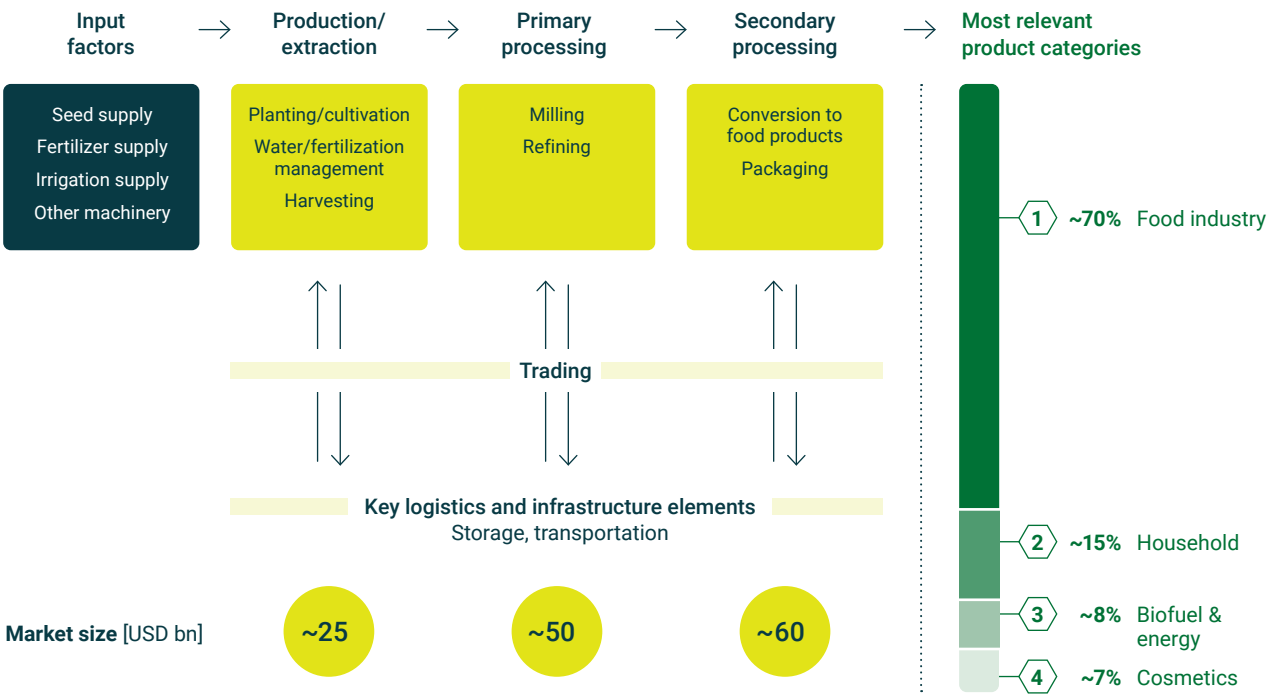
CHALLENGES – DEFENDING JOBS BUT GETTING SERIOUS ABOUT SUSTAINABILITY

Reconciling IsDB member countries' economic dependence on palm oil with the industry's devastating environmental impact sets sustainability apart as the foremost challenge in the years ahead. In the period from 2000 through 2016, as demand flourished, Indonesian palm oil plantations quadrupled their workforce from two million to about eight million people. Yet there have been few gains in productivity or sustainability, as output and profitability increases have been achieved through serious harm to the environment. For Malaysia and Indonesia, where palm oil is a mainstay of the economy, resolving this dilemma is crucial.

POSITION OF IsDB COUNTRIES – STRONG, STRONGER, SUSTAINABLE?

The limited vertical integration that already exists among the IsDB-based players that dominate global palm oil output gives them significant control over the downstream value chain, though this influence weakens considerably at the secondary processing level. Trade flows between IsDB countries are well established – for example, more than 50% of Indonesia's palm oil exports are received by other members. The UAE imports all of its palm oil from IsDB member countries – 74% from Indonesia and 26% from Malaysia.

PALM OIL | Global value chain overview



Some 71 million tons of palm oil were produced from 272 million tons of palm oil fruit in 2018. Recent CAGR of well over 5% could edge even higher in the coming years. And with value growth projected to climb by 14.3% p.a., total palm oil sales should nearly quadruple between today and 2030. Primarily used by the food industry and in household products, palm oil accounts for an impressive 85% of most relevant products (by retail value).

Taken together, all IsDB members account for 87% of global palm oil production, with Indonesia and Malaysia by far the biggest producing countries. The top five corporate producers are likewise based in IsDB countries and are vertically integrated in the primary processing stage. At this stage in the value chain, kernel oil is extracted mainly for use in non-foods, while palm fruit oil is also channeled into food products. Singapore-based Wilmar International is both a major primary processor and the world's leading palm oil trader.

By contrast, only a few of the global players in the secondary processing market – which adds more value (55%) than any other link in the value chain – are based in IsDB countries, such as IFFCO, a major UAE-based integrated food and non-food manufacturer in Indonesia.

With the outlook for continued strong market growth, IsDB countries possess huge potential to add value and create jobs by subsidizing local secondary processors and/or supporting international players (such as UAE-based IFFCO) that have a footprint in the IsDB region.

Even so, speedy adjustments must be made. It is important to embrace and strictly enforce sustainable farming initiatives. Once such measures are in place, investment can be plowed into local secondary processors and cooperative ventures with large players from other IsDB countries.

2.3

RICE

- **A growing global population demands more and higher-quality rice – and more resource-efficient production**
- **IsDB countries produce almost a quarter of the world's rice – but are almost all net importers**
- **By shifting from flooded to aerobic rice cultivation, IsDB countries can save water, increase yields and reduce methane emissions**

2030 AND BEYOND – DRIP IRRIGATION AND FAIR TRADE

Rice yields must increase as the world's population grows while available farmland remains constant. Conventional rice cultivation under flooded conditions consumes 30 to 45% of the world's freshwater resources. With many IsDB countries suffering from severe water shortage, shifting from flooded to aerobic cultivation with drip irrigation could become a game changer in the near future. Flooded paddy cultivation contributes some 20% of methane greenhouse gas emissions. Aerobic cultivation would reduce these emissions significantly. Under aerobic cultivation, the use of drip irrigation will likely be pivotal to more efficient water use, with studies showing that it can increase rice yields by 29% and reduce water consumption by 50%. Rolled out on a large scale – especially where larger rice farms or organized cooperatives can afford the heavy initial investment – drip irrigation could be instrumental in making rice cultivation more sustainable and efficient.

Pressure to make the rice value chain more sustainable is growing. The Sustainable Rice Platform has established the first Standard on Sustainable Rice Cultivation, which, among other efforts toward certification, may help shape the rice market for years to come.

CHALLENGES – WATER USE EFFICIENCY, FARMER EMPOWERMENT

Given its importance as a food source, the global rice value chain necessarily addresses several of the United Nations' Sustainable Development Goals (SDGs).

Rice is a vital ingredient in the global fight against poverty and hunger. The backbone of many local economies, it yields a comparatively cheap and easy-to-process crop as a staple diet. Yet since rice growing consumes from 30 – 45% of the world's fresh water, the industry is keen to improve water use efficiency.

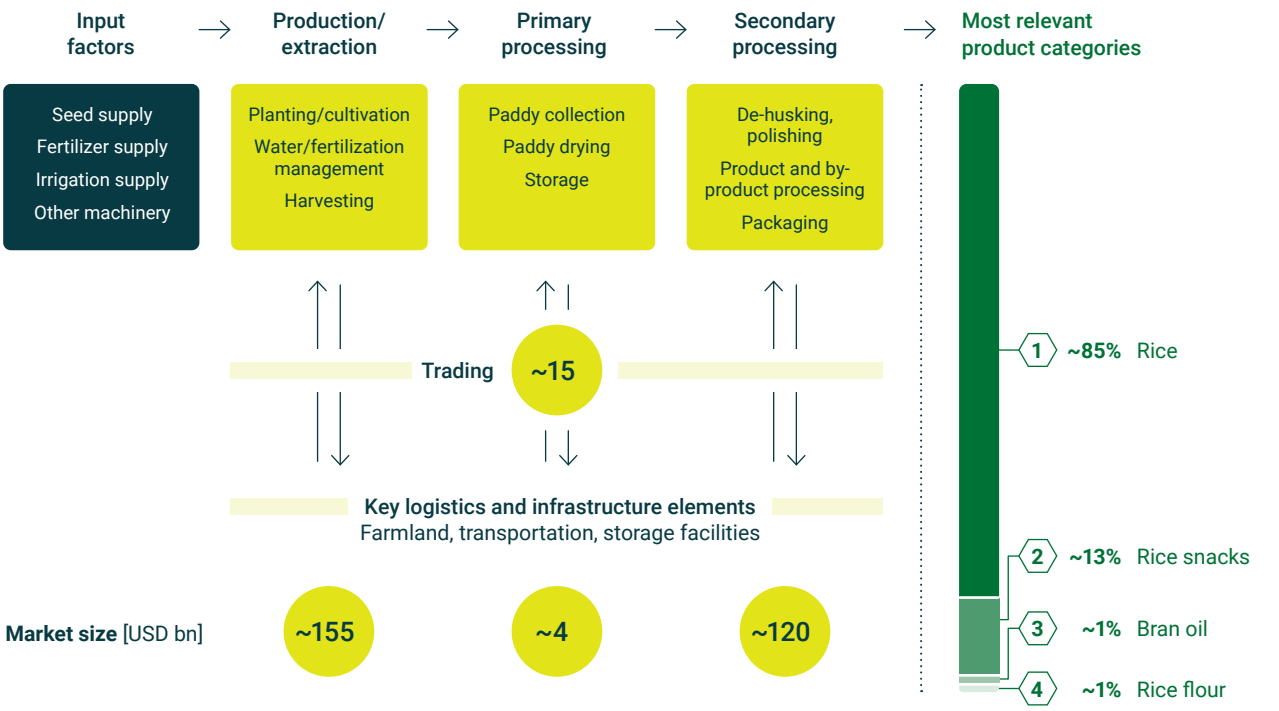
Several large-scale global research programs have been launched to tackle these issues. One of them is RICE, a consortium led by the International Rice Research Institute (IRRI), the Africa Rice Center, and the International Center for Tropical Agriculture. RICE aims to empower small rice farmers around the world by transferring knowledge and technology to boost productivity, reduce water usage, improve value chain integration, improve business models, and attract young entrepreneurs into rice value chains.

POSITION OF IsDB COUNTRIES – STRONG ON PRODUCTION, UPSIDE POTENTIAL

While IsDB countries cultivate nearly a quarter of all the world's paddy rice and Indonesia and Bangladesh are global-scale producers, Pakistan is the only major net exporter. Owing to their nearly exclusive focus on production and primary processing, these countries are not integrated into the global rice trade and also miss out on higher-value secondary processing.

UAE-based rice trader Phoenix Agrifoods exemplifies how IsDB member states can build up a presence in the

RICE | Global value chain overview



Rice is the second most consumed crop in the world today, with global production reaching 782 million tons (510 million tons of milled rice) in 2018. While CAGR should stay constant at between 1.0 and 1.5% through 2030, demand is expected to outstrip production as early as 2021.

Some 90% of global output is produced in Asia, with around half of total production concentrated in just two countries, China and India. The largest IsDB-based rice producers are Indonesia, Bangladesh and Pakistan, who together account for roughly 20% of global output. Rice is still a very labor-intensive crop in most countries, with many small farms and little industrialization. Short of storage facilities, small farmers often have to sell their crops immediately, leaving primary processing – a minor link in the value chain – to millers and traders. Rice trading itself is geographically fragmented and conducted by private multi-commodity trading companies. **Phoenix Agrifoods,** a UAE-based player, for example, trades almost 2 million tons of rice annually, representing some 4% of the global rice trade.

Secondary processing (such as milling, packaging and distribution) varies depending on end-product requirements. Growing demand for rice in general and higher-quality rice in particular is pushing up prices, however, and secondary processors can add significant value at this level.

growing international rice trade while giving small farmers access to the market. In secondary processing, Saudi Arabia's Al Doha represents the sole top 10 player from the IsDB member countries. Al Doha processes and packages quality rice, showing how local champions can capture value at the more profitable end of the market. Given the rice industry's vast importance for food supply and employment, IsDB investments should focus on helping farmers raise production efficiency. Doing so will increase yields while controlling costs, integrate more productive small farmers into the global value chain and enlarge IsDB members' share of global rice trade flows. By adopting genetically modified golden rice, with its larger grain size and superior nutritional value, and rolling out more resilient, resource-efficient farming systems, IsDB countries can carve out a competitive advantage for themselves.

2.3

FISH

- **The urgent problem of overfishing is being tackled largely by aquaculture, whose share of fish volumes has surged from a quarter to nearly half in two decades**
- **IsDB countries account for 18% of global fish production – Indonesia is their top fish producer and the number two player in the world**
- **Investment in IsDB countries should focus on reducing overfishing, boosting aquaculture and building up secondary processing capabilities**

2030 AND BEYOND – CHAMPIONING SUSTAINABILITY

With further growth in demand for fish and overfishing becoming critical for more and more fish grounds, aquaculture will be a key trend over the decade to come. Global volumes from aquaculture are expected to surpass those from wild capture by 2021. The trend is fostered by start-up companies, who are harnessing new technologies to make aquaculture more efficient. Jala, for example, provides devices that monitor the quality of pond water in shrimp ponds.

With indoor vertical farming becoming a water-saving way to produce vegetables in particularly arid IsDB member states, the combination of indoor farming and fish production in aquaponic systems might evolve into much more than just a niche in the near future, especially for many IsDB member countries that suffer from water scarcity and limited resources for domestic food supply.

To combat overfishing, certification programs have created multiple labels in recent years to establish global sustainability standards. This development is gradually making the fishing and seafood value chain more efficient and more reliable. A subset of this issue is the question of traceability. Advanced technologies in general and the use of radio-frequency identification (RFID) tags in particular could help plug loopholes that still facilitate the incorrect labeling of as much as 30% of the fish and seafood sold worldwide. In one pilot project, RFID implants in captured fish are proving a powerful tool to prevent illegal and unsustainable fishing practices.

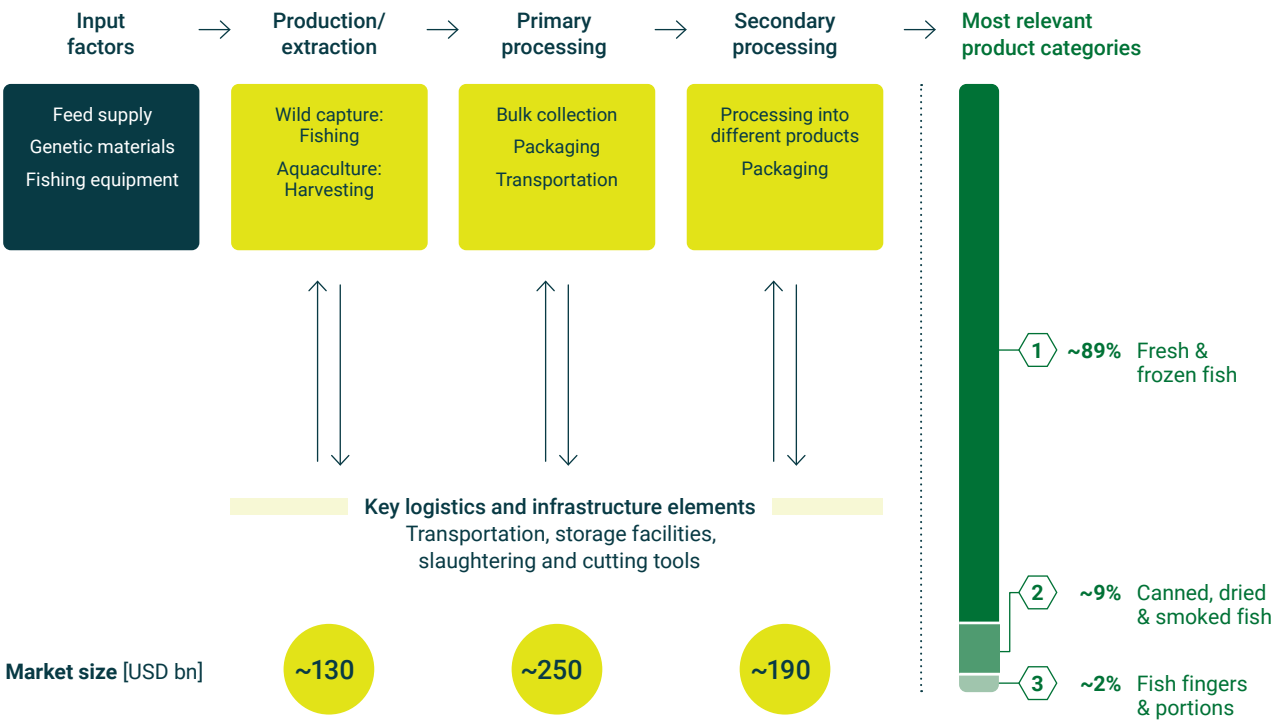
CHALLENGES – OVERFISHING, SDGs AND ISSUES WITH AQUACULTURE

Overfishing is the biggest challenge facing the industry today. Growth in demand from some of the world's biggest populations (including China and India) continues to drive the worldwide overexploitation of finite fish resources. Yet overfishing erodes biodiversity and adversely affects life below water.

Efforts to alleviate these issues by ramping up aquaculture face challenges of their own, however: Even in regions such as Norway, where the practice is quite advanced, the high cost of animal feed and high fish mortality rate are just two of several factors that impair cost efficiency and keep aquaculture more expensive than wild capture.

POSITION OF IsDB COUNTRIES – A GLOBAL HEAVYWEIGHT IN THE MAKING

IsDB countries supply nearly one fifth of the world's fish, with Indonesia (8% of the global fish market) and Bangladesh (2%) the region's biggest players. Yet the importance of this industry to GDP and employment in such countries needs to be matched by initiatives to intensify sustainability and overcome the bane of overfishing.



The global market for fish and seafood reached 176 million tons in 2018 and should continue to see CAGR of 1.8% through 2030. Although secondary processing creates far more value per unit sold than either production or primary processing, only a tiny proportion of fish actually reaches this link in the value chain. The market's dominant players in any case pursue a policy of full vertical integration across the entire value chain.

While industrial fishing fleets and individual fishermen caught three quarters of the world's fish diet wild (in oceans and inland waters) as recently as 2000, aquaculture had whittled this share down to just over half by 2018 and is expected to overtake it in the years ahead.

In the years ahead, certification programs will be flanked by technological advances and an increase in controlled and sustainable aquaculture. Besides the RFID tagging technology described above, Indonesia's eFishery, for example, is supplying fish farmers with a mobile app that helps cut out overfeeding and can reportedly cut feed costs by over 20%.

Investment in IsDB countries' fishing activities should therefore focus on the move from wild capture (and overfishing) to aquaculture, alongside the need to develop secondary processing capabilities. While the latter are currently in short supply among IsDB members, Dubai-based fully integrated producer Asmak nevertheless ranks 16th in the world. It is important to follow this example, because a deeper commitment to secondary processing – through new companies and cooperation with existing players – could transform countries such as Indonesia, and the whole IsDB region, into a genuine global heavyweight in the fish industry. Here, IsDB countries hold great potential for investors due to low operating costs – for example, Indonesia has 39% lower total operating costs than the average of the five key ASEAN countries.

2.3

POULTRY

- **Demand should grow constantly through 2030, but plant-based and cultured tissue substitutes will capture market share in the long term**

- **IsDB countries play a significant role in global poultry production – One Saudi Arabian player ranks eleventh in the line-up of top producers**

- **With increasing local demand, poultry production in IsDB member countries shows high potential for growth, revealing attractive investment opportunities – Investment should focus on making IsDB-based players more competitive and ramping up local and regional feed supply chains**

2030 AND BEYOND – A GROWING, AFFLUENT AND HEALTH-AWARE POPULATION

Trends on both the demand and supply sides will affect the poultry industry going forward.

A growing global population, mainly in developing countries, and increasing affluence leading to a more protein-rich nutritional intake are powerful drivers of demand for poultry meat. Especially in developed countries, a rise in health awareness should further encourage consumers' preference for poultry over other types of meat. And at the retail level, consumer demand for processed ready-to-eat or ready-to-heat poultry products mirrors the growing importance of convenience as a third key trend. On the other hand, poultry is also affected by growing awareness of the downsides of meat consumption, especially among consumers in developed countries. Consumers' growing concern for animal welfare has so far mainly led to disruptive changes in the EU market, such as a ban on the caging of laying hens. However, this may well also become an issue in IsDB countries over the next decade.

Supply-sided, market players are actively looking for sustainable production methods. This is widely linked to improving transparency with regard to animal welfare, genetic input factors and improving the environmental impact of production and animals' manure. These activities will put additional cost constraints on producers, forcing the market to further consolidate to achieve economies of scale and maintain profitability.

CHALLENGES – SUSTAINABILITY-DRIVEN DISRUPTORS

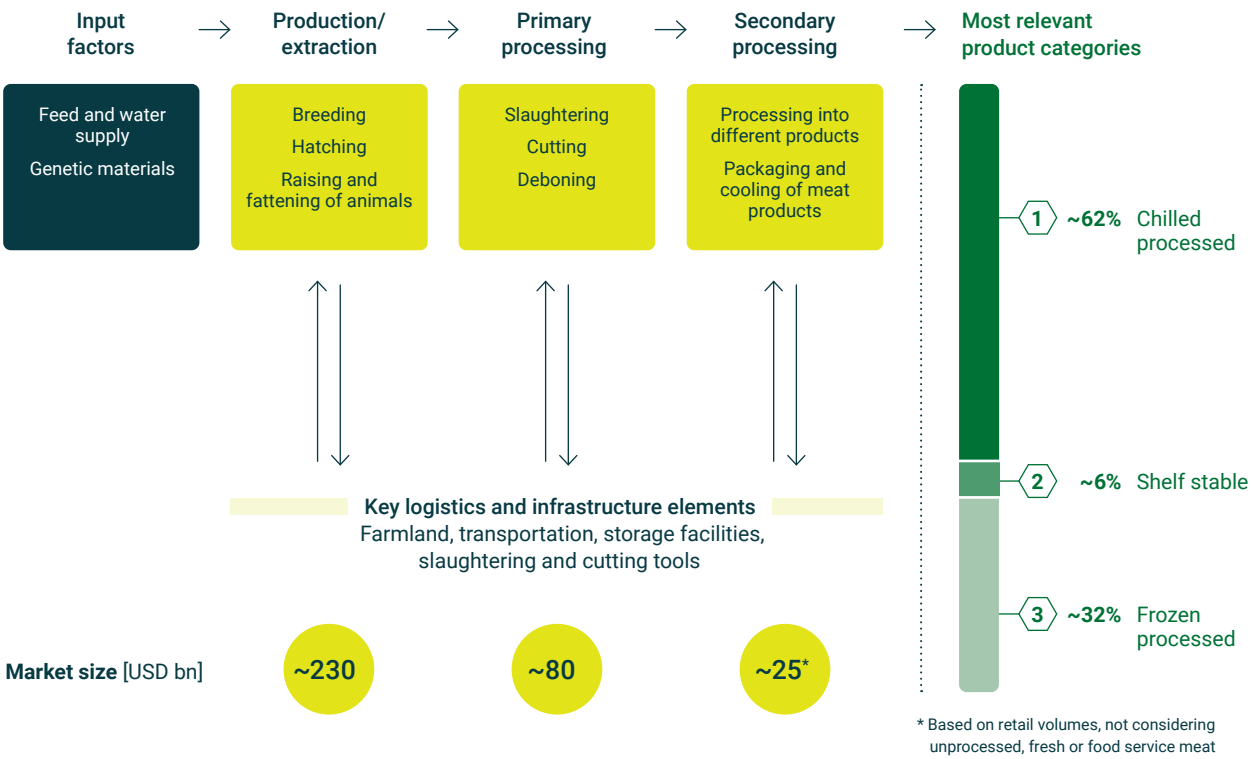
In the future, poultry meat will face competition from meat grown from cell cultures in laboratories. Producing this "clean meat" has a far smaller land footprint and uses much less water than conventional meat production, making this alternative considerably more sustainable. One large-scale project in India (one of many examples worldwide) has the express mission of providing an entire country with animal-based products produced in a controlled environment instead of breeding and slaughtering animals.

At the same time, the increasing consumption of plant-based meat substitutes is another disruptive force in the making. By 2030, both of these factors are expected to be affecting the poultry industry, though it will continue to grow. Tighter governmental regulations in terms of sustainable production, i.e. animal welfare and environmental impact, will undoubtedly add to the cost pressure on producers.

POSITION OF IsDB COUNTRIES – BUILDING ON EXISTING STRENGTHS

For a set of countries that account for almost a quarter of the world's population, poultry production among IsDB members is still under-represented compared to global

POULTRY | Global value chain overview



Poultry production (hatching, raising and fattening) totaled 147 million tons in 2018. Volume growth of 2.2% and value growth of 3.9% are expected through 2030. Asia Pacific, the Middle East and Africa are the principal regional drivers of growth.

Poultry farming breaks down into two very distinct types: Traditional small-scale poultry farming in developing regions involves mostly manual labor and focuses primarily on self-consumption. It plays a significant role in sustaining livelihoods by creating employment and supplying rural areas with poultry products. But it cannot compare with the large-scale, fully industrialized and profit-focused operations that prevail in countries such as the USA. This report focuses essentially on industrialized value chains, where production accounts for 25%, primary processing about 10% and secondary processing the remaining 65% of overall value. Most global players combine all three steps in their vertically integrated value chains.

market players. Yet there are still a number of serious players – such as ACOLID (in 11th place worldwide) and Americana Group (16th) – that do originate from IsDB member states and invest heavily in their businesses. Another major player is an Oman-based joint venture between IFFCO Poultry Company and Atyab Investments. The joint venture ranks as the global number 22 in terms of processing capacity. The company is engaged in a fully integrated poultry operation comprising of hatchery, broiler farms, processing facilities and distribution. Productivity ratios can be improved, however, and animal feed shortages leave countries such as Saudi Arabia heavily dependent on imports and, hence, vulnerable to supply chain disruptions.

To combat the global trend toward market consolidation and avoid becoming dependent on global poultry players from the USA, China and Brazil, for example, IsDB countries need to invest in further strengthening their already strong leading players. At the same time, more advanced processing technology and input factors must be made available to smaller local production operations to add value and create jobs. Robust local, regional and supra-regional feed supply chains must also be established as a firm foundation for a thriving poultry business.

Flock of harvesters bringing in “sea rice” in Lianyungang, China

Agricultural equipment increases farming productivity

3

HOW READY ARE IsDB COUNTRIES FOR THE FUTURE?

IsDB countries present diverse opportunities and challenges – Tailored approaches are required

IsDB member countries were assessed and grouped into three heterogeneous country clusters – Future readiness assessments were then conducted and recommended actions derived

"Productivity champions" need to invest in innovation and sustainability to unlock further market potential

Productivity champions exhibit high agricultural productivity and are integrated in the value chains – They need to focus on innovation and sustainability in order to maintain output levels and increase competitiveness

"Production-focused countries" should expand their processing footprint to increase their share of the market value

Production-focused countries have established production operations but display limited processing capabilities and infrastructure constraints – They should further expand processing activities to increase value creation in agri-food and unlock export potential

"Domestic market potentials" can increase productivity through mechanization and governance improvements

Domestic market potentials currently exhibit low agricultural productivity – They can increase their output levels through workforce qualification, investments in technology and improvement of governance and regulation

IsDB countries need to make their agri-food industries fit for the future

Among other consequences, food scarcity and unemployment are expected to rise if current challenges are not addressed by IsDB member states – Failure to take action will threaten the viability of the agri-food sector in the long-term

3.1

STARTING POINTS FOR IsDB COUNTRIES

Three main clusters with similar market characteristics

To better tailor action plans and investment opportunities, three country clusters were created among IsDB countries. The country clustering was based on the amount of available farmland in IsDB countries*, the employment rate in the agriculture industry, the farmland productivity, as well as IsDB countries' geographic position and value creation potential linked to the former analyzed value chains.

Productivity champions

- **Countries with agricultural sectors of global importance**
- **Above-average farming productivity value creation potential in processing often not yet fully exploited**

Arab Republic of Egypt
Islamic Republic of Pakistan
Kingdom of Saudi Arabia
Kyrgyz Republic
Malaysia
People's Republic of Bangladesh
Republic of Albania
Republic of Azerbaijan
Republic of Indonesia
Republic of Iraq
Republic of Sudan
Republic of Tajikistan
Republic of Turkey
Republic of Uzbekistan
Sultanate of Oman

Domestic market potentials

- **Countries with high labor intensity and in need of basic production technologies**
- **Lower productivity combined with high employment in agriculture**

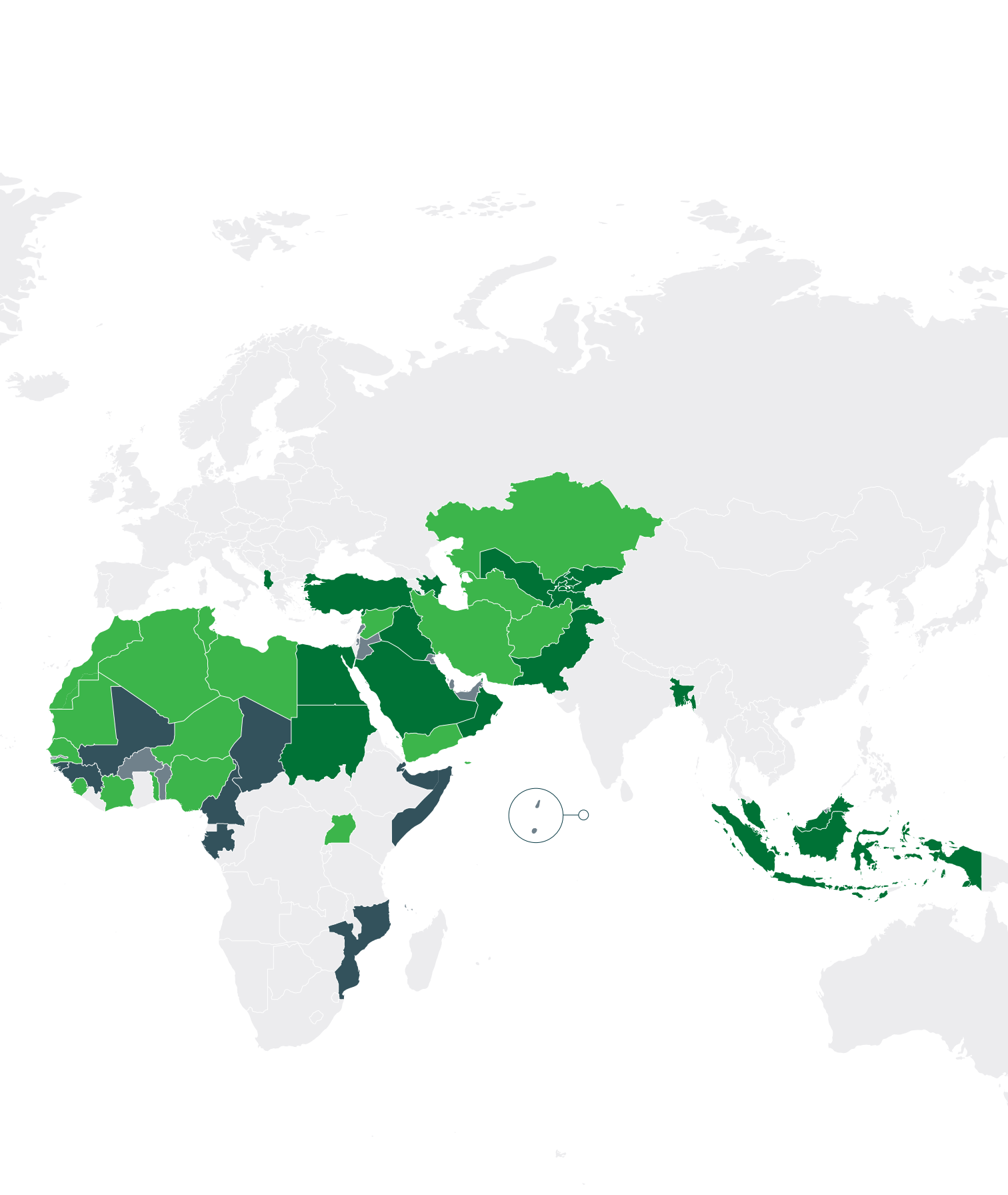
Federal Republic of Somalia
Republic of Cameroon
Republic of Chad
Republic of Djibouti
Republic of Guinea Bissau
Republic of Gabon
Republic of Guinea
Republic of Mali
Republic of Mozambique

Production-focused countries

- **Below-average farming productivity and primarily low labor force employment in agriculture**
- **Countries with established agricultural sector but often insufficient infrastructure backbone**

Cooperative Republic of Guyana
Democratic and People's Republic of Algeria
Federal Republic of Nigeria
Islamic Republic of Afghanistan
Islamic Republic of Iran
Islamic Republic of Mauritania
Kingdom of Morocco
Republic of Côte d'Ivoire
Republic of Kazakhstan
Republic of Niger
Republic of Senegal
Republic of Sierra Leone
Republic of Togo
Republic of Tunisia
Republic of Uganda
Republic of Yemen
State of Libya
Syrian Arab Republic
Turkmenistan

* IsDB member countries with very limited farmland and production opportunities were not analyzed further.



3.1

STARTING POINTS FOR IsDB COUNTRIES

Arable farmland, labor force and productivity as filters

Following on from the analysis of opportunities for IsDB member countries in global agri-food industries, the overall future readiness of IsDB countries was assessed. This "readiness assessment" takes a broader perspective, looking at sector capabilities, framework conditions, access to finance and sector competitiveness, as will be explained in detail in the next chapter. Outcomes of the global industry analysis also feed into the respective future readiness assessments.

Each member country has its own individual natural resources, industrial strengths and areas of expertise. Yet they do share similarities. To better understand the agri-food strengths and opportunities of IsDB member countries and to better customize future action plans, the 57 members were evaluated and grouped into clusters. This section outlines the methodology used.

EVALUATION AND CLUSTERING

Two filters were applied to cluster member countries.

The **first filter** assessed **available,** ranking members according to their relevant agri-food production opportunities. Farmland was defined as agricultural land area that is arable, under permanent crops or under permanent pastures. Rankings were formulated based on the absolute amount of arable farmland. To ensure a focus on production capacities, countries with limited relevant production opportunities were removed from the process (deprioritized) at this stage. This left 43 countries.

The **second filter** then examined the **labor force** in the agricultural sector, alongside the associated aspect of **relative farming productivity.** Labor force was calculated by dividing World Bank data on the number of people active in the agricultural sector by the population of the country. This generated the share of population active in the agricultural sector.

Farming productivity was derived based on yields. As all crops have different yields per harvested area, these differences had to be balanced out. For example, the average yield of cocoa among IsDB members is 0.43 tons per hectare, compared to 5.52 tons per hectare for wheat. Yield benchmarks were created for each industry to determine whether a country was above or below the average productivity. The cut-off point for high productivity was determined at 50% above average productivity.

THE RESULTS

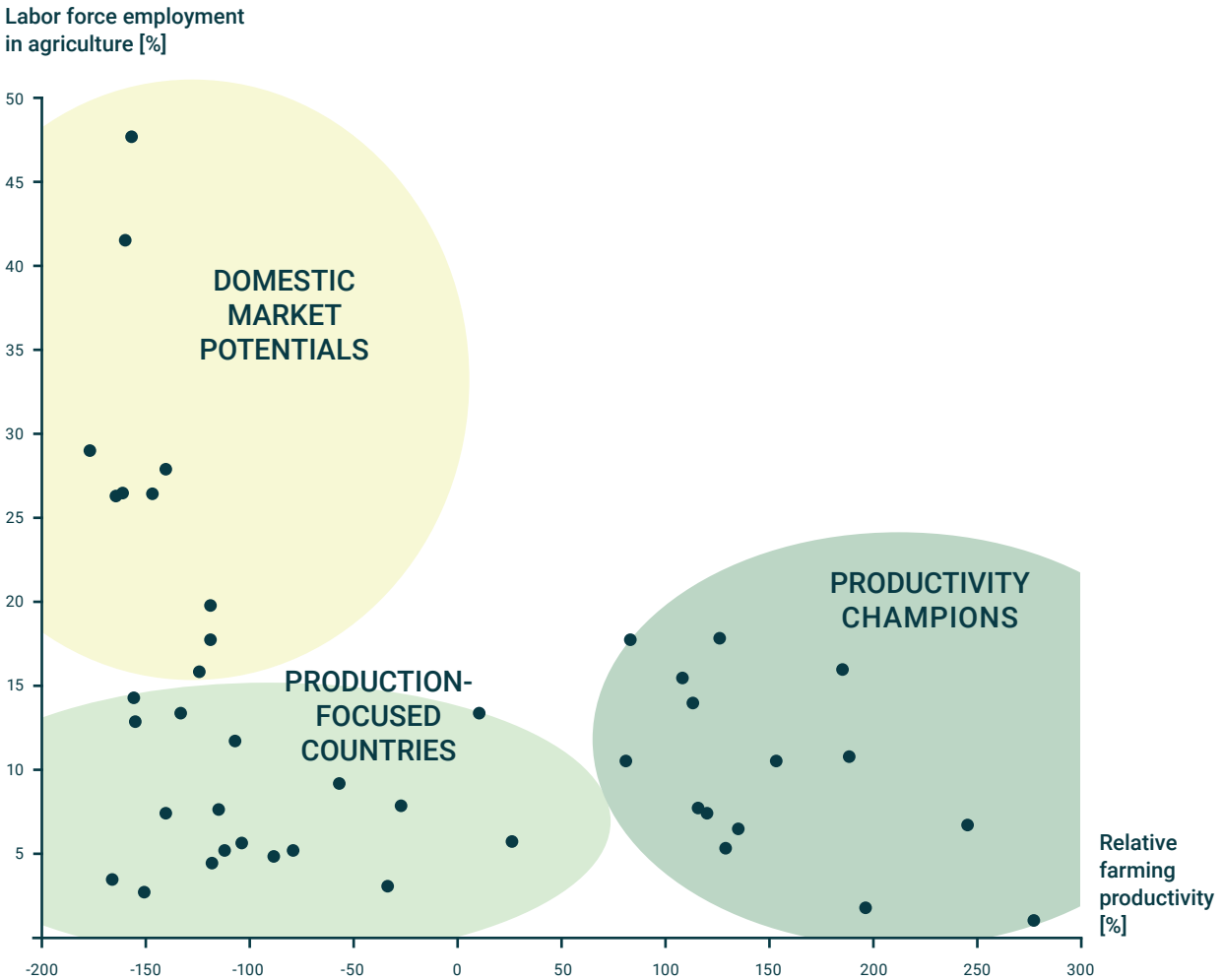
Results combining these two factors saw three clusters emerge, as shown in the illustration above.

Countries in the first cluster, **"Domestic market potentials",** are characterized by a high labor intensity and lack of basic production technologies. More than 15% of the overall population work in the agri-food sector. Nevertheless, their farming productivity is well below the average of the other IsDB members. Representative countries are Somalia, Niger and Mozambique.

If decisive action is taken today, by 2030, domestic market potentials could eradicate severe food insecurity for at least 40 million people. In addition, it can improve qualification and income levels for 53 million people working in agriculture.

The second cluster, **"Production-focused countries",** consists of states with an established agri-food sector. However, they often have below average productivity and poor transportation infrastructure. Employment in agriculture is primarily low, with less than 15% of the population working in the sector, and farming productivity is below average. Countries include Nigeria, Kazakhstan and Côte d'Ivoire.

Three different clusters of IsDB countries



By transforming their labor markets, production-focused countries can provide higher qualified jobs and improved income levels to 116 million people in the agri-food sector

The third cluster comprises **"Productivity champions",** whose agri-food sectors are of global importance. Their farming productivity figures are more than 50% above average compared to other IsDB members, while their agricultural labor force is primarily low (<20%). Countries in the cluster are mainly active in the production step of the value chain, and their value creation potential in processing is often not yet fully exploited. Sample countries are Malaysia, Indonesia and Egypt.

By 2030, productivity champions can generate additional agri-food exports worth USD 380 bn, if they invest in innovation and sustainability today to further strengthen their agri-food sectors.

3.2
FUTURE READINESS ASSESSMENT
Status quo and scenario 2030 per cluster

A country having potential in a particular industry is one thing, but realizing that potential takes considerable effort and dedication. One good indicator of likely future success is the current state of play within the agri-food sector.

Now that IsDB member countries have been clustered and prioritized according to their agri-business potential, the next step is to assess their readiness to compete in global markets. This is achieved by compiling individual readiness assessments. These were created for 11 prioritized IsDB member countries.

The first section of this chapter outlines the methodology used. The second section provides detailed readiness assessments of three countries chosen as examples, one for each cluster: Somalia (Domestic market potentials), Côte d'Ivoire (Production-focused countries) and Indonesia (Productivity champions).

READINESS ASSESSMENT METHODOLOGY

To assess the readiness of the agri-food sectors of prioritized IsDB member countries, each was scored across four dimensions comprising 13 indicators. These markers were designed to assess a country's degree of industrial readiness to integrate into the global industry and compete on the open market. They are based on development criteria from, for example, the UN and World Bank, as well as expert opinion and project experience. Combined, the dimensions and indicators provide a holistic view of the status quo in a country's agri-food sector, They also highlight where specific actions are needed to improve this position.

An example of a readiness assessment summary is presented in the diagram at right. The red, orange, yellow and green zones indicate the degree of readiness to compete at a global level, with red as the lowest. The country's current (status quo) level for each indicator is displayed as a gray line and its potential future position as a blue line. Red flashes highlight key areas for action.

DIMENSIONS AND INDICATORS

The four dimensions consist of 13 indicators, highlighted below.

Access to finance: Finance takes various forms, three of which are used as indicators – grants, debt and equity. Grants, normally awarded by donors to develop an industry, are usually the first source of financing. As the industry grows, debt financing becomes available, which requires the borrower to take on risk. Finally, private investors may provide equity. Such investments are known as local or foreign direct investments (FDI).

Sector competitiveness: The first indicator, scale, refers to the size and professionalism of farming activities, ranging from subsistence agriculture to farming cooperatives.

Assessment dimensions

Top performance
Full competitiveness on a global scale, best practice for innovation and efficiency

Acceptable performance
Partially integrated value chains, productivity and innovation constraints

Room for improvement
Competitiveness on a national level, constraints in the framework conditions

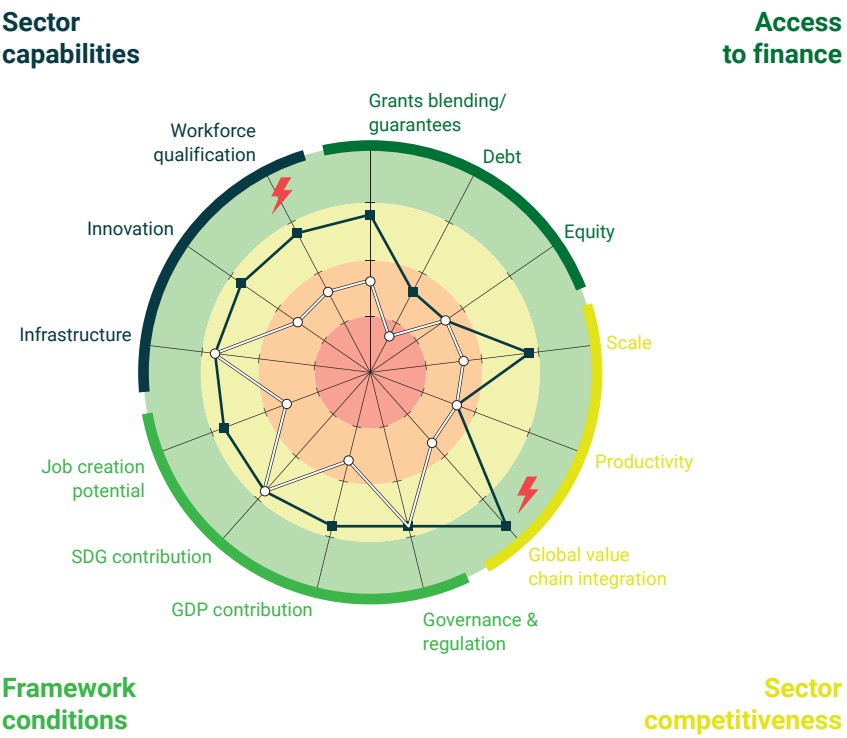
Critical deficit
Focus on subsistence and local markets, lack of access to finance

Potential positioning for 2030

Current level

Key field of action

Future readiness assessment



Productivity covers the labor and investment needed to generate a certain gross value add and yield in agri-food projects. For example, irrigation and mechanization result in higher productivity. Lastly, global value chain integration describes to what degree a country's products are competitive on international markets.

Sector capabilities: The workforce qualification indicator measures education levels across global industry steps, with the presumption that better educated workers generate more value. Innovation accounts for how closely operations mirror international best practice. Access to infrastructure covers ease of transport and basic services, such as electricity supply.

Framework conditions: Job creation potential refers to the current number of jobs and average wages in the sector, on a scale favoring better paid, skilled jobs. SDG (Sustainable Development Goals) contribution concerns the degree to which use of resources, energy and other factors affecting the environment and people is sustainable. Carbon neutrality would be a positive example. GDP contribution refers to the gross value added by the agri-food sector, while governance & regulation measures the quality of the regulatory framework and adherence to it. This last indicator is the most important, since it helps set the framework conditions for the other twelve.

3.2
FUTURE READINESS ASSESSMENT
Productivity champions

"Productivity champions" already boast agricultural sectors of global importance with high productivity. For this cluster to increase its competitiveness, the main task is to use innovation to develop sustainable farming while training the workforce to adopt new technologies. **Indonesia** is detailed as a representative of the cluster.

COUNTRY OVERVIEW

Indonesia's 268 million residents (with a fairly young median age of 30 years) make the country the fourth most populous in the world. Average annual income of USD 3,700 translated into GDP of USD 999 bn in 2018. That makes Indonesia the largest economy of all IsDB members and the 16th-biggest in the world.

The agri-food sector plays a crucial role, accounting for 13% of GDP, 25% of all exports and 30% of the workforce. These figures imply relatively low labor productivity compared to other sectors and downstream segments of the agri-food value chain.

Indonesia is the world's largest palm oil producer, with output of 41 million tons per year. It is strong in trading and primary processing, but less so in secondary processing. The country is also the world's third-largest rice producer and the IsDB region's biggest meat producer. Cocoa, coffee, tea and tropical spices are other significant Indonesian agri-food products.

However, the country still relies on imports of staple goods such as wheat, soybeans, sugar and onions, while struggling with sustainability issues, mainly related to its palm oil plantations. Scattered far and wide, the thousands of islands in the Indonesian archipelago often make logistics a challenge.

READINESS ASSESSMENT

Apart from access to finance, Indonesia generally performs very well and promises future development across all categories. Over the next 10 years, it should focus on driving sustainability through innovation, workforce optimization and diversification of its agri-food portfolio.

ACCESS TO FINANCE

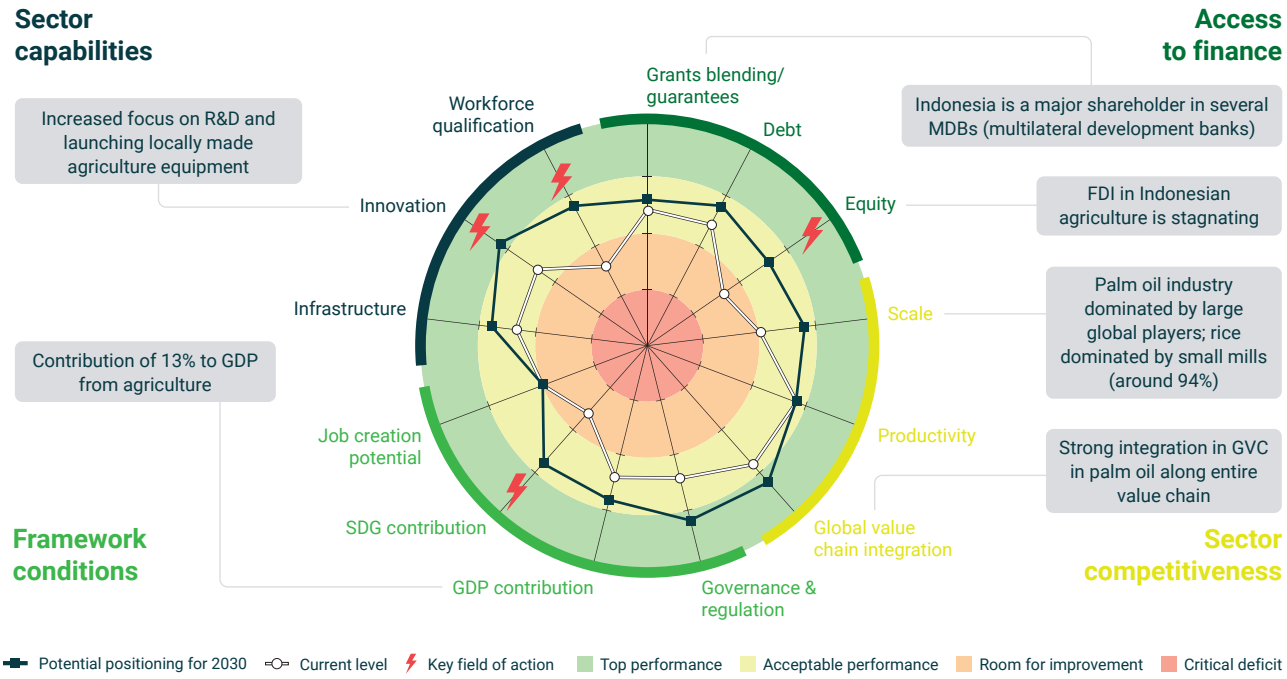
Access to finance shows acceptable performance across all indicators, aside from equity, which exhibits room for improvement.

The Asian Development Bank (ADB) – one of many sources of grants to support the agri-food sector – approved a USD 600 m loan in 2017 to improve the maintenance and operation of irrigation systems and water delivery to farmers across the country. Food security improved and rural poverty declined as a result. The International Fund for Agricultural Development (IFAD) is currently providing more than USD 669 m in financing for five projects to enhance the delivery of agricultural services.

In 2018, the Asian Infrastructure Investment Bank (AIIB) approved USD 250 m to modernize and rehabilitate the country's irrigation system. The Ministry of Agriculture implemented a strategic plan from 2015 to 2019 to achieve food sovereignty and improve farmers' welfare. With ample support available and some industries already able to compete globally, the next step should be to steer these industries toward sustainability by supporting ecofriendly practices.

Debt financing mainly supports global players and SMEs that have steady incomes and collateral. Most small farmers do not meet these criteria, however, and can only access microloans from a broad range of microfinance institutions dominated by Bank Rakyat Indonesia (BRI), the

Readiness assessment, Indonesia



largest state-owned commercial bank.

Agri-tech start-up TaniGroup is another provider of microloans to small farmers. Its TaniHub B2B platform lets farmers sell directly to retailers. The lender claims that its microloan funds, by giving farmers access to working capital, have helped increase farmers overall income by more than 60%. Forward-looking alternative lending programs have a total expected transaction value of USD 42 m (equivalent to 13,000 loans) in 2020 and CAGR of around 13% projected through 2023.

Structural factors that hinder scaling in Indonesia's farm sector include the difficulty of making robust risk assessments (especially in rural regions), low profitability, lack of collateral (for smallholders), lack of revenue guarantees and weather-related risks. Loan availability to larger players is comparable to that in developed economies.

Indonesia has scope to improve its equity financing, as only selected industries – such as palm oil and aquaculture – are attractive enough to appeal to foreign investors. Singapore supports more than 5,000 projects across multiple sectors, including agriculture and agri-food, and is the largest foreign investor in Indonesia.

Viable solutions are needed to give farmers access to working capital. One prominent example is peer-to-peer lending start-up CROWDE, which conducts risk assessments for farm cooperatives and facilitates direct investment opportunities on a B2B platform. However, meager gains in production and efficiency have kept FDI in the Indonesian agri-food sector stagnant in recent years. Promoting investment opportunities to international investors and conducting sound risk assessments could ease this situation.

SECTOR COMPETITIVENESS

The sector competitiveness dimension displays acceptable performance across all indicators.

While Indonesia's agri-food sector compares well with its peers in other IsDB countries, rice and other industries are still dominated by small farms and have room to improve on scale. Conversely, just five large players control about 90% of the global palm oil market. In this fairly consolidated industry, 54% of land used to plant palm trees is managed by private companies, 41% by SMEs and 5% by the government (though the vast majority of SMEs are smallholders who sell their harvest to larger players).

Aquaculture is not as heavily concentrated as palm oil and has lately been growing by about 4% p.a. Some 90% of production is consumed locally, as fish is an important

3.2
FUTURE READINESS ASSESSMENT
Productivity champions

staple and source of protein.

Consolidation will continue in these industries as smaller players join forces or are absorbed by larger ones. Productivity in the agri-food sector was up 27% between 2005 and 2016, and Indonesia's farms are the fourth most productive among IsDB countries.

Global value chain integration in this sector is mostly driven by Indonesia's leading position throughout the entire palm oil value chain. The country also has a large footprint in production and a moderate presence in primary processing in the subsistence-focused rice industry. The same goes for the meat and fish industries, which exported only about 10% of their production in 2018.

SECTOR CAPABILITIES

Indonesia's sector capabilities are broadly acceptable, apart from workforce qualification, which has room to improve.

The country ranks 54th in the World Bank's 2018 Infrastructure Index and is fairly advanced by IsDB standards. President Widodo's strategy reportedly views infrastructure as a key to distributing economic growth and wealth beyond the main island of Java. Infrastructure projects worth USD 412 bn (about 60% for transportation) are planned between now and 2024.

State-funded initiatives also support innovations that boost productivity, lower the risk of crop failure and cut production costs. Examples include 24 programs for local producers of agricultural machinery and equipment (e.g. for automatic seeding, soil crushing/rolling and hybrid pumps).

Workforce qualification ranks 113th in the UN Education Index, with a comparatively high score by IsDB standards. However, unequal access to higher education and outdated curricula present challenges. Only 16% of all Indonesians complete tertiary education – far fewer than the OECD average of 44%. The country currently has some 87 million students and a teacher-student ratio of 7:100. To address these issues, the government should invest in the education sector (marketplaces, online class platforms, school management systems and student loans).

FRAMEWORK CONDITIONS

The defined framework conditions all exhibit acceptable performance, except SDG contribution, where there is room for improvement. Starting a business, doing business, paying taxes and trading across borders are all comparatively easy by IsDB standards. Rigid employment and minimum wage regulations need improvement.

Indonesia has a diversified economy to which the agri-food sector makes a significant contribution, accounting for 13% of GDP (a mid-table position among IsDB members). The country's SDG contribution, however, suffers from the situation in the palm oil industry, which urgently needs to become more sustainable.

Though labor-intensive practices are still widespread, the potential for creating new jobs will shift from production toward processing. Overall, Indonesia is representative of its cluster. Its key economic factors and ratings across all 13 indicators are similar to those of peer countries in the same cluster.

SCENARIO 2030

By 2030, Indonesia will be a highly diversified regional food hub for Asia, with a strong position in the production of staples and high-value-added products such as fish, palm oil, rice, coffee and cocoa. It will have further integrated its value chains, acquiring a moderate to strong position in the primary processing for each of its top five production sectors and a strong position in the secondary processing

of palm oil.

By leveraging private sector expertise, private equity and grants, Indonesia will have evolved into an innovation hub for smart agri-food practices. Funding initiatives such as the distribution of innovative seeds, agricultural input factors and machinery will have raised productivity by spreading modern farming methods to the majority of farmers.

Indonesia will have halted the loss of fertile soil and rainforests caused by deforestation and monoculture. It will have implemented clear regulatory and international certification standards, guaranteeing environment-friendly production methods for its top agri-food sectors, such as palm oil, fish, rice, coffee and cocoa.

RECOMMENDED ACTIONS

To sustain its current production level and increase output in new sectors, Indonesia must focus on sustainability and innovation, taking immediate steps to halt deforestation, monoculture and soil erosion.

To eradicate farming methods that harm the environment, adapt to growing customer awareness of eco-friendly and organic products, and foster traceability along the value chain, the country must invest in innovation and workforce qualification. It should also encourage more private sector involvement in the development of green agri-food practices, as large global players are heavily invested in Indonesian palm oil and themselves face pressure due to adverse climate impacts.

Here, Indonesia should strive to set up an innovation agency, which would help facilitate and finance cooperation and brainstorming between start-ups and established players.

Introducing organic farming methods can increase revenue, because processors and customers in developed countries are willing to pay more for these products. At the same time, Indonesia must adopt clear industry standards and regulations, especially in palm oil, and allow the production and planting process to be closely monitored by an independent body or the RSPO.

Selective grants and subsidies should encourage agri-tech start-ups to find innovative solutions to current sustainability problems. In addition, Indonesia should set up an innovation hub focused on research in smart agri-food technology and methods, in cooperation with start-ups, large private players and SMEs. As new technologies mature, the country should continue its efforts to disseminate innovation in rural areas. Funding initiatives that provide new input factors (such as innovative seeds, improved fertilizer and new machinery) to small and medium-sized farmers should be continued.

While pushing innovation, Indonesia should also provide training to help the workforce adopt new technologies and educate farmers on the proper use of crop protection and fertilizers. This will systematically reduce environmental footprints and soil erosion. Here, the state authorities can provide teaching and learning facilities, leveraging the in-depth expertise of existing private players who have an inherent motivation to upgrade their workforces and improve their businesses.

Besides improving current output, Indonesia should diversify and strengthen its export portfolio to reduce dependency on palm oil. Similarly, it should build on its already strong production capacity in fish, rice, coffee and cocoa to further develop primary and secondary processing.

3.2
FUTURE READINESS ASSESSMENT
Production-focused countries

"Production-focused countries" have an established agri-food sector with a focus on the production step of the value chain. They face difficulties in framework conditions such as infrastructure and financing. Global value chain integration, especially boosting processing with the help of new technology and education, is a major field of action for this cluster to develop its future competitiveness. **Côte d'Ivoire** is examined here as a representative example for the cluster.

COUNTRY OVERVIEW

The 54th-largest country in the world by population, Côte d'Ivoire has 25 million inhabitants with a very low median age of 21 years. Annual incomes average USD 1,600, which equated to GDP of USD 41 bn in 2018. The country's economy is the 25th-largest in the IsDB and 95th worldwide.

Agriculture accounts for a substantial 21% of GDP, 73% of exports and 48% of the workforce. These figures imply relatively low labor productivity.

Côte d'Ivoire is the world's leading producer of cocoa, accounting for 37% of global output in 2018. This single commodity accounts for more than 50% of the country's exports. After pronounced price volatility in recent years, uncertainty has diminished and the outlook has turned positive for cocoa farmers, as prices have stabilized and are forecast higher through 2030.

The country produces some rubber and is self-sufficient in cassava, yams and bananas. Conversely, it depends heavily on imports of food staples such as rice, dairy products, meat and fish, with local production insufficient to ensure food safety. Total imports of USD 10.3 bn far outstripped exports of USD 8.4 bn in 2018.

After years of turmoil and fighting following the 2010 elections, Côte d'Ivoire's internal political situation has stabilized in recent years.

READINESS ASSESSMENT

Despite a poor showing on financial measures, Côte d'Ivoire registers acceptable performance in the governance and regulation, SGD contribution and infrastructure categories. There is room for improvement across the board, but the prospects for the next 10 years look very promising. All indicators are pointing up.

ACCESS TO FINANCE

Access to finance is the lowest-ranked dimension for Côte d'Ivoire. Grants and equity leave room for improvement; debt shows critical deficits.

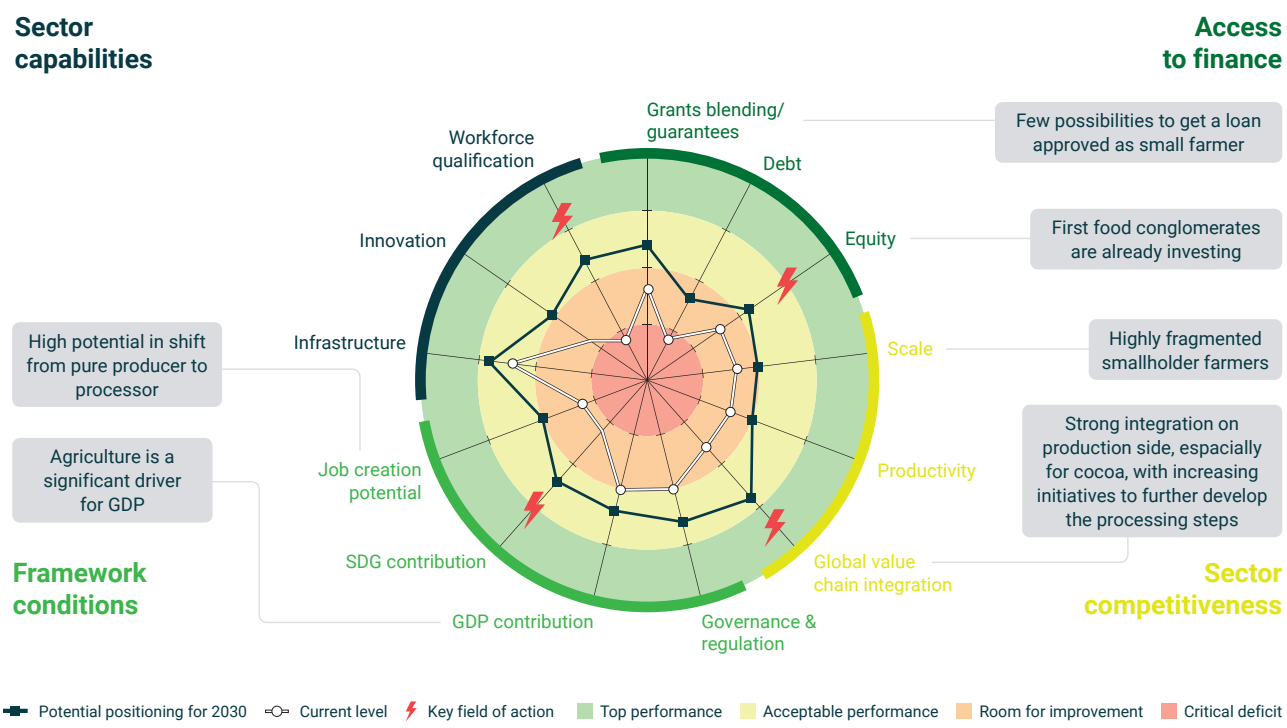
A National Development Plan spells out how the government wants to advance the country. In 2012–2016, the first phase of the plan distributed USD 3.2 bn to expand production capacity in key industries such as cocoa, coffee, cashews and cotton, boosting revenues across the sector.

Phase Two (2017–2025) aims to improve storage, processing and marketing of agricultural products in line with the cluster strategy proposed for production-focused countries. This will involve more extensive in-country processing of agricultural raw materials and diversification.

Donors such as CDC Investment Works, the African Development Bank and KfW Bank support local development and complement state-funded programs. CDC funds a program centered around AgriTech, which distributes agricultural input factors and equipment to 300,000 farms – 90% of them micro and small-scale producers.

Striving to improve irrigation, the African Development Bank has created 1,712 jobs in recent years. Food production has increased by 3,982 tons since the program began. Meanwhile, AfDB's ENABLE Youth program aims

Readiness assessment, Côte d'Ivoire



to train the next generation of agriculture entrepreneurs, creating many new businesses and driving employment. The score for debt is low because small farmers lacking a regular income or sufficient collateral have little chance of getting a loan. The First Microfinance Agency Côte d'Ivoire (PAMF-CI) is an exception to this rule, granting half of its loans to rural customers (and more than a third overall to women). To diversify risk, the agency lends mainly to groups of farmers, with most loans going to improve productivity, acquire livestock, diversify products and launch small businesses.

A USD 19 m loan from the International Fund for Agricultural Development (IFAD) to Côte d'Ivoire is helping boost incomes and improve food security for over 32,500 households. In addition, a USD 70 m credit from the International Development Association (IDA) should improve rural access to digital services, boosting farm productivity and giving farmers better access to the market.

There is more equity than debt financing thanks to government incentives (such as tax rebates) encouraging the private sector to invest in the country.

In the FDI arena, Cargill works closely with cocoa farmers to source locally grown beans, while Nestlé is fighting child labor across the agri-food sector. Given Côte d'Ivoire's strong position in cocoa production, more and more foreign players will likely invest here.

SECTOR COMPETITIVENESS

Sector competitiveness fares better than access to finance, with all indicators showing room for improvement.

Small cocoa farmers in particular have formed cooperatives to benefit from economies of scale. While selective investments will continue to help cooperatives grow and scale up their production, support for small farmers remains crucial to the sustainable development of the country's agri-food sector. Some 600,000 cocoa farms, for example, now employ about 6 million people.

Productivity is slightly higher than the IsDB benchmark and has improved in recent years, but other countries have progressed faster in recent rankings. This underlines the importance for upscaling to consistently translate into higher overall productivity. Nestlé and Mars have recently launched initiatives to introduce high-yield, disease-resistant cocoa trees, rehabilitate old cocoa gardens and encourage

3.2
FUTURE READINESS ASSESSMENT
Production-focused countries

best practices.

Global value chain integration is healthy, benefiting from deep integration on the production side plus some primary processing, especially for cocoa. Côte d'Ivoire today produces about 40% of the world's cocoa beans but only 29% of paste, 12% of butter and a small amount of powder. Current state programs focus mainly on production.

SECTOR CAPABILITIES

Côte d'Ivoire's sector capabilities are a mixed bag: Performance on infrastructure is acceptable, innovation can be improved and workforce education reveals critical deficits.

The country ranks 56th in the World Bank's 2018 Infrastructure Index and is reasonably advanced by IsDB standards. However, the unequal distribution and poor diversification of infrastructure creates long and expensive commute times for workers from rural areas. Transportation expenditure (including opportunity cost) totaled USD 2.4 bn in 2017, which is about 5% of GDP.

Even though Côte d'Ivoire was graded on innovation as having room for improvement, start-ups are emerging in the FinTech and agricultural sectors. One innovative agri-business – Canaan Agriculture Sarl, which started as a nursery for plantains and bananas – generated revenue of USD 180,000 in 2018 by combining farmer advisory services with the creation and maintenance of plantations. The owner was trained under the West Africa Agricultural Productivity Program (WAAPP), which highlights how important such programs are to innovation. More money should be devoted to such agricultural start-ups, which strengthen both the farm sector and the whole economy in the long run.

Workforce qualifications in Côte d'Ivoire are poor by IsDB standards and have a lowly ranking of 165th in the UN Education Index. Less than half of the country's over-15s can read and write, with overall adult literacy standing at 47% in 2018. A staggering literacy gender gap of over 13% also reflects inequality issues.

Workforce qualifications must improve drastically if the country is to operate on an equal footing with international players. Education budgets must rise sharply, while training programs are needed to support the industrialization and expansion of processing capabilities together with foreign equity investors.

FRAMEWORK CONDITIONS

Governance and regulation are 126th globally in the Ease of Doing Business ranking. An acceptable score of 61 puts this criterion above the IsDB average, with sound prospects for ongoing improvement. Positive categories include starting a business, getting credit, enforcing contracts and resolving insolvencies. Improvement potential exists for trading across borders and dealing with construction permits.

Agri-food is a significant driver of the economy, contributing a stable 21% to GDP and ranking 14th among IsDB countries. As processing activities increase, gradual integration in the value chain will allow the sector to capture even more value.

The country's SDG contribution ranks 129th in the 2019 SDG Index. While improvement is foreseen in this sector over the next decade, child labor remains a serious issue throughout the cocoa industry, with numbers reportedly as high as 500,000 in 2016. However, the government revised its hazardous work list in 2018 and affirmed the need to constrain child labor.

Job creation potential is currently low, since the agri-food industry already accounted for about 48% of employment in 2018. In the future, the shift from pure production to

processing should generate high-value-added jobs, while mechanizing production should raise output volumes and productivity.

SCENARIO 2030

By 2030, Côte d'Ivoire will be the frontrunner in responsible cocoa production and processing. It will have transformed its business model, heavily integrating its value chain in primary processing, and to some extent in secondary processing.

The country will have devoted substantial resources to creating a research center for alternative farming methods. It will have learned to protect biodiversity without hurting production, strengthening its future position as a productivity champion in cocoa. International certification, transparency and monitoring will also ensure good working conditions for farmers.

Côte d'Ivoire will also have diversified its agri-food sector, attaining strong positions in the production and primary processing of maize, poultry and fish.

RECOMMENDED ACTIONS

As a production-focused country with an established market position in cocoa, Côte d'Ivoire should integrate further in primary and especially secondary processing to gain access to the highest value-adding segments in this industry. It should also diversify its production and processing portfolio to reduce dependency on cocoa by expanding capacity in maize, poultry and fish.

To protect biodiversity, Côte d'Ivoire needs to implement clear regulations, especially regarding deforestation and responsible working conditions. Adopting third-party certifications is one way to make quick progress in this area. The country should target a private-public cooperation model for responsible farming (like the Lindt & Sprüngli Farming Program in Ghana) in a holistic approach that covers everything from traceability and farmer organization to training, knowledge transfer, internal monitoring and investment in inputs and new plants.

Côte d'Ivoire should also aim for increased sustainability along the entire value chain. Waste from plant-based production, especially cocoa husks, could offer good investment opportunities to biogas companies looking for reliable feed supplies. In Indonesia, for example, EnviTech Biogas is already cooperating with palm oil producer PT Herfinta Farm & Plantation.

Access to finance will be needed for start-up investments, workforce qualifications and suitable regulation must be put in place to improve production quality, and infrastructure must be upgraded to speed up export processing.

Loans and FDI are required to ramp up production and processing capacity. Côte d'Ivoire should provide loans to help small farmers improve their yield and quality. For processing facilities, the government should encourage private equity investments by large global players, offering support and investment guarantees.

Only by producing at higher quality standards can Côte d'Ivoire become a successful player on global markets. This can be accomplished through joint vocational training centers combining public (co-)financing with private sector expertise, quick adoption of international hygiene, health and safety standards, widespread certification and exchange of information, and use of modern machinery.

Lastly, Côte d'Ivoire should invest in its overland supply chains to slash lead times (by road or rail) that are currently twice as high as in some of its sub-Saharan peers.

3.2
FUTURE READINESS ASSESSMENT
Domestic market potentials

"Domestic market potentials" are countries whose agricultural productivity is low owing to a low level of mechanization. Ensuring food security for the population and building sound governance and regulatory mechanisms are major actions for this cluster. **Somalia** is detailed as a representative example for the cluster.

COUNTRY OVERVIEW

A median age of just 18 years makes Somalia – whose population of 15 million ranks 72nd in the world – one of the 10 youngest nations. Average annual income of USD 100 per capita in 2018 added up to GDP of USD 1 bn, ranking 54th among the IsDB member countries and 187th worldwide.

Agriculture accounts for 55% of GDP, 97% of exports and 72% of the workforce. Yet despite being the mainstay of Somalia's economy, farm output is not sufficient to guarantee food security. The country exports small quantities of live animals and produces meat, sugar and milk, but remains dependent on imports and international development aid.

Having emerged from over two decades of civil war, Somalia has recently made progress in establishing permanent political, economic and security institutions. Nevertheless, acute challenges abound. Foremost among them are a deteriorating water and transportation infrastructure, weak regulatory and enabling institutions, and severe degradation of the environment.

Even so, Somalia's growth prospects give cause for optimism, thanks to vast tracts of arable land and a variety of habitats conducive to expanding farming and livestock grazing. Focused actions and international development partners could expedite the transition from short-term recovery and humanitarian response to long-term development and sustained sector growth.

READINESS ASSESSMENT

Except for infrastructure and job creation potential, where there is merely room for improvement, Somalia's condition is critical across virtually all assessed criteria. Over the next 10 years, the country should focus on ensuring food security for the population and building sound governance and regulatory mechanisms.

ACCESS TO FINANCE

Access to finance exhibits critical deficits across all indicators.

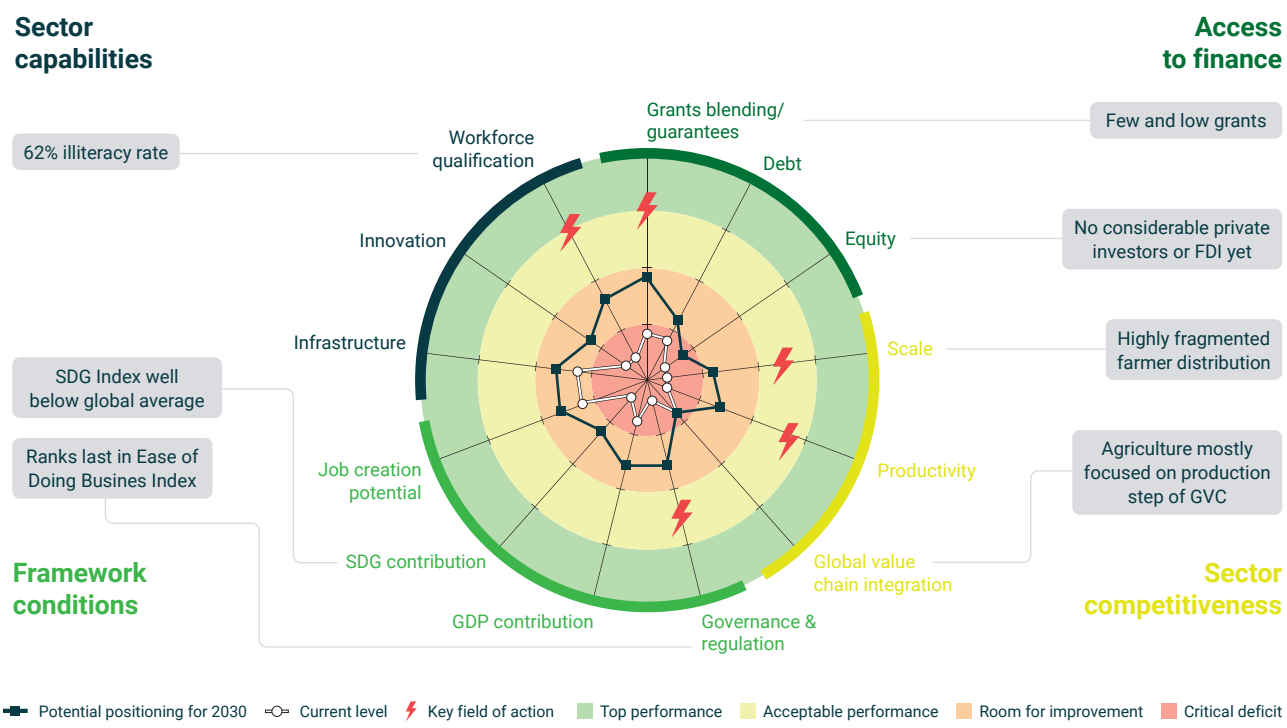
Somalia lacks mid-sized and larger grants. Small grants are on offer from a few investors, such as the UN's Food and Agriculture Organization (FAO), the African Development Bank and Agrikaab, an agri-food tech start-up. The average size and distribution of grants will likely increase once the country has recovered from recent droughts and flooding.

Before the next planting season, Somalia must also combat a desert locust plague that currently threatens food security and livelihoods. To support this effort in East Africa, the ASTF, an Africa-led fund to support African development initiatives, has donated USD 1 m to the FAO.

Debt financing is hindered by the poor availability of regular loans from banks and other lenders. Some small investors, such as Somali AgriFood Fund, provide seed capital for diaspora investments in agri-food and rural businesses, where providers are still few and far between due to the extreme weather conditions. The fund fronts a partnership between the International Fund for Agricultural Development, Shuraako and the BiD Network and has given corporate players access to financial capital since 2013.

So far, the Somali AgriFood Fund has awarded more than USD 2 m to pursue three main goals: economic development, job creation and enhanced food security. Barwaaqo, a local

Readiness assessment, Somalia



fruit and vegetable wholesaler and cooperative, showcases the potential impact by bringing farmers together into larger distribution networks.

Somalia does not yet have an equity financing sector, since neither a local private sector nor FDI has been established to any meaningful degree. A few small investment initiatives are helping fuel the local economy, however. The Nordic Horn of Africa Opportunities Fund, launched in 2018, provides USD 10 m to support small and medium-sized companies. This fund was created in cooperation with Norfund (the largest contributor), Shuraako and the IFU (a Danish development finance institution). It promotes sustainable development and emphasizes Somalia's attractiveness to foreign investors.

SECTOR COMPETITIVENESS

Somalia scores poorly across all categories of sector competitiveness. It needs substantial support to develop scale and productivity levels that would enable food security in the near future.

The scale of agriculture currently ranks as very low. Farmers cultivate small parcels of land individually, rather than larger plots in cooperatives. International support is focused on the short-term priority of restoring production capacity and assets.

The productivity of Somalia's agri-food sector is currently the lowest of any IsDB country. Since this indicator depends on workforce education and a host of other factors, change requires addressing each factor individually. Current measures to improve efficiency include mechanizing agriculture, rehabilitating the irrigation infrastructure, establishing water catchments, building feeder roads and promoting seed production systems.

Somalia's integration into the global value chain is minimal, but for now, this issue must bow to food security as the top priority. Domestic output currently covers just half of the population's consumption of cereals and other foods. Once production has scaled up and become more efficient, Somalia can begin moving up the value chain into processing.

SECTOR CAPABILITIES

The capabilities of Somalia's agricultural sector are mixed: Infrastructure has room for improvement, while both

3.2
FUTURE READINESS ASSESSMENT
Domestic market potentials

innovation and workforce education reveal critical deficits.

Somalia ranks 157th in the World Bank's 2018 Infrastructure Index, way below the average for IsDB member countries. Yet anticipated progress in access to investment finance, for example, could make it easier to build roads and guarantee grants for machine leasing, allowing this an expected improvement to this score. An overall rise in working and living conditions should follow. Moreover, several initiatives – such as the AfDB-led Multi-Partner Somalia Infrastructure Fund (SIF) – are already committed to rehabilitating and developing Somalia's infrastructure.

At present, innovation is in short supply and must play second fiddle to more pressing concerns, some of which may be overcome through sustainable mechanization once basic living conditions have stabilized. That said, initiatives such as the farm-based livelihood project by the Norwegian Refugee Council (NRC) are key to strengthening Somalia's agricultural sector in the long term. Part of the Building Resilient Communities in Somalia (BRCiS) initiative, this project seeks to leverage new technologies to introduce modern farming techniques in rural areas. The 50 farmers who participate receive training in sustainable farming techniques and apply what they learn to their daily work.

Somalia's workforce qualification score is at the very bottom of the UN's Education Index due to a lack of data. Drastic improvement is critical, as this key driver can positively impact all the other indicators. Primary school enrollments are disturbingly low, at 30%, falling to only 18% for children from rural households. A lack of formal education is one reason for the country's reported 25% rate of youth unemployment – though UNICEF puts the actual jobless rate for under-30s at 67%.

Since education is such a powerful driver and the scope for improvement in this area is enormous, initiatives must be launched. Even universal basic education would represent considerable progress at a relatively manageable cost. To make a start, the Department for International Development (DFID) has earmarked USD 2 m to give more than 24,000 children access to quality education.

FRAMEWORK CONDITIONS

Apart from job creation potential, which has room for improvement, all framework conditions rank in the critical deficit category.

Governance and regulation in Somalia rank last in the global Ease of Doing Business Index. This indicator is crucial, because other initiatives will remain ineffective without suitable framework conditions. Experts call for governance to be prioritized as the number one precondition for rapid development.

The country's SDG contribution does not even rank in the UN's Sustainability Goals Index. Although the goal of food security is paramount, at least a minimum standard should nevertheless be targeted in the near future. Lack of data makes comparison with international benchmarks impossible.

Agricultural output accounts for 55% of Somalia's GDP today and is forecast to rise, indicating the sector can make a positive contribution to economic growth. In relative terms, this is the second-highest GDP contribution by any IsDB member country, albeit the Somali agri-food sector ranks 54th in absolute output.

As for job creation potential, an employment rate of 72% in agriculture (very high compared to other countries) seems to preclude much progress. Even at these levels, Somalia has problems ensuring food security.

SCENARIO 2030

By 2030, Somalia will have built up resilient local production capacity, leveraging both its fertile soils and its highly diverse marine life. Mechanization will have significantly reduced food scarcity by improving efficiency and increasing production volumes for maize and livestock.

The local population will have better access to vocational education and infrastructure. Improved governance and the rule of law – built around greater transparency, accountability and investor protection – will lay the foundation for future economic growth and foreign investment.

In the long term, Somalia is geographically well placed to take its share of global trade flows. Once set with a firm foundation for growth, it can diversify its production portfolio and expand regional exports.

RECOMMENDED ACTIONS

To raise output and satisfy domestic food needs, Somalia should focus on scale and productivity, primarily by mechanizing farm output. This will require upfront investment to finance machinery, input factors and training.

With national resources limited, Somalia must find ways to attract financing from international donors. International organizations see political stability and reliable institutions as a prerequisite for development aid. Accordingly, the country must first improve its governance and regulations by cementing the rule of law, accountability, enforcement and investor protections. These steps will also draw more foreign private investors over the long term.

Besides rural infrastructure, the focus of international investments should be on microloans to enable small farmers and cooperatives to sustainably mechanize agriculture. The government should offer more creative approaches to make technology more accessible – for example, through leasing of machinery or innovation centers in major farming areas, set up in cooperation with development banks and/or international organizations.

Sector capability actions must accompany such financing programs, as mechanization will not work without the appropriate training. To compensate for missing educational infrastructure in rural areas, mobile training units should be formed. Somalia should build on existing campaigns with international development agencies to drive vocational education in agriculture.

Here, the Somalis can borrow existing best practices from other countries such as Indonesia, where Unilever has sponsored a "Palm Oil Field School" in Sumatra to scale rural education with a "train-the-trainer" approach. In this case, high-performing farmers are taught how to conduct face-to-face field training for their neighbors in rural areas.

Beyond these key actions, farmers will need better infrastructure – modern roads for transporting goods, levees and canals for flood protection – to step up production. The country must also invest in reservoirs to improve irrigation and cool storage to prolong the shelf life of agri-food products.

In the long term, Somalia should diversify its product portfolio, concentrating on maize and vegetables for domestic consumption and cattle and fish for export. Potential export destinations could include neighbors such as Kenya and more distant customers such as Oman and China (already Somalia's principal export targets). Tax incentives for production and processing facilities could be one way to encourage (regional) private sector players to invest in these sectors.

3.3

WHAT HAPPENS IF WE DON'T CHANGE?

Six main impacts

Showing significant potential across many agricultural industries, IsDB countries present a world of opportunity for international investors. Having looked in detail at sample country clusters and the chances that they represent, it is worth taking a moment to look at the flipside of the picture. What will happen if IsDB member countries fail to take action through the pandemic and beyond ?"

Inaction will enhance pressure on already scarce resources and increase food insecurity. Failure to invest in human capital will result in a lack of education and innovation as well as vulnerable employment. This will disadvantage IsDB's agri-food markets as they seek to compete with global players. Failure to shift toward sustainable, resource-saving agriculture will impose increased costs upon agri-food players as stricter environmental protection regulation and sanctions emerge.

IsDB member countries that fail to eliminate bottlenecks in the flow of goods and labor during the pandemic will lead to a vast amount of productivity losses throughout the agriculture value chain. The product most affected will be perishable products like fruits, vegetables, meat, dairy, and fish.

Due to the high export concentration of agriculture inputs like fertilizer, pesticides, and animal feeds places a high degree of risk on the functioning of the logistics and transportation systems. The inability of governments to connect farmers with inputs will decrease yields resulting in the reduction of production, creating further pressure on the countries food systems. The lack of pesticides in East Africa has hampered the containment of the current locust, which exasperates food insecurity leading to potential famine.

Failure to enhance agriculture value chains and create social safety nets for low income and net food importing member countries are at high risk to the disruption in global supply chains and price volatility. If the price of grains surges, the population in these countries will be forced into poverty, as seen in the 2007-08 food crises. The expected impact of coronavirus will push 60 million people into extreme poverty, and global poverty will record its first increase since 1998. Below, each of these negative outcomes and their impact on the IsDB countries is considered in turn.

SCARCITY OF RESOURCES

Overuse of pesticides and fertilizers, deforestation as well as monoculture farming are corroding fertile soil around the globe. This leads to a decrease of arable land, thus diminishing agricultural output. Droughts and water scarcity are exacerbating the problem as harvest failures occur more frequently due to lack of sufficient irrigation. This especially affects developing countries such as IsDB members, where environmental protection control as well as smart soil monitoring and modern fertilizer management is often not yet commonly used. This threatens the livelihood of farmers and food security in affected countries in the short term, and it will also decrease global food supply over the long term.

FOOD INSECURITY

Besides resource scarcity, a failure to increase production capacities and productivity as well as supply chain infrastructure is threatening food security given that a 25% increase in food calories, compared to 2010 levels, will be required by 2030 to feed the global population. Rural areas with lacking transportation infrastructure and new "megacities" alike will face significant challenges in terms of stretching supply chains to provide the population with food. As several IsDB countries already face moderate to severe food insecurity, especially in Eastern and sub- Saharan Africa, the declining food supply will likely hit those regions the hardest, also leading to growing political unrest and instability.

LACK OF INNOVATION

Stagnating or even decreasing access to education will hamper future innovation both in the agri-food sector itself and in enabling sectors such as transportation infrastructure. This will increase countries' vulnerability to climate change, natural disasters and diseases, as advances in climate- and disease-resilient crops and smart farming methods will not be implemented. As a result, agricultural output will remain low, hampering a country's potential to create high-value-adding agri-food sectors. In addition, low workforce qualification and weak infrastructure will cause a decline in FDI as investors will likely divert their investments to countries with better framework conditions. As the agrifood sector contributes up to 57% of some IsDB member countries' GDP, this will result in significant economic downturns in those countries.

Drought-ridden soil and dead palm trees

Extreme climatic and environmental events pose high risks for food security

LOSS OF COMPETITIVENESS TO GLOBAL PLAYERS

The combination of the aforementioned challenges and the increasing consolidation of productivity champions and integration along the value chain places considerable competitive pressure on IsDB countries. While integrated global players gain more control over the value chain, thus increasing their value add and profit margins, IsDB members miss out on the opportunities that the growing agri-food sector is offering. As customer demand in developed markets is changing toward more sustainable and organic products, agri-food players need to be able to better cater to these requirements. Stagnating implementation of modern technologies as well as responsible production leaves countries at a competitive disadvantage against more innovative players, increasing the risk of them being pushed out of the market in the long term.

VULNERABLE EMPLOYMENT

Lack of education, stagnating technological developments as well as decreasing agricultural output due to resource scarcity will reduce the potential to generate decent and profitable employment in the agri-food industry. Private sector players will likely seek to divert their businesses toward more productive and profitable markets, reducing or relinquishing jobs in agri-food industries. Small-scale farmers will likely lack the resources to further finance their agri-businesses, pushing them further into subsistence farming and making them more vulnerable to informal or hazardous working conditions as well as poverty. As agriculture contributes more than 70 % of the total workforce in some IsDB countries, this will have severe impacts on the livelihood of farmers as well as on national GDP.

HIGHER COSTS OWING TO ENVIRONMENTAL PROTECTION

Stricter environmental regulation, due to increasing resource scarcity as well as pressure from consumers to produce responsibly and reduce CO_2 emissions, will increase the pressure on private sector players to adapt their business models. Farming will also become more expensive, as intense farming methods require additional resources and decrease available farmland in the long run. Failure to invest in innovation and transformation now will likely increase the cost along the entire value chain over the coming years for IsDB countries.

Likewise, failure to address current challenges will likely hinder IsDB member countries in progressing beyond their current capabilities and will threaten the viability of their agri-food sectors in the long term. As agriculture forms the backbone of many IsDB countries' economies, this will make them less resilient and more prone to natural, economic or political crises. Consequently, poverty, hunger and political instability may arise causing a deterioration in the living conditions and SDG development of IsDB member countries.

A tractor spraying fertilizers

The use of fertilizers and crop protection increases agricultural productivity – However, smallholder farmers often lack access to the finance to afford them. Mutual loan guarantee schemes for cooperatives as well as machinery leasing pools can help to bridge this financing gap

4

HOW TO UNLOCK THE POTENTIAL OF IsDB COUNTRIES

Digital solutions can be leveraged to improve farmers' living conditions

Digital solutions can boost farmers' incomes – Crop planning tools, data-based farm practices, online advisory services and marketing can support especially small farms in remote areas and connect them to the value chain

Cooperative leasing models can enable mechanization and strengthen smallholders' productivity

Mechanization improves productivity and yields, but is often unaffordable for smallholder farmers – Innovative leasing models can connect lenders, equipment providers and farmers to drive mechanization

Management systems offer potential to improve sustainability in production

Effective control measures need to be introduced to stop deforestation and loss of biodiversity, but farmers often lack technical assistance and know-how – Modern management systems can enhance transparency

Private sector involvement is crucial to drive the expansion of value-adding processing

Processing agricultural output in the country of origin offers higher value creation, but private players often perceive investments in IsDB countries as risky – Risk-sharing and cooperation models between the private and public sector can drive future development

IsDB offers attractive collaboration models for private sector partners

IsDB member countries operate in high-potential agri-food industries – IsDB offers joint project financing and risk sharing as well as access to high-level decision makers to incentivize collaboration

4.1
KEY FIELDS OF ACTION
Improving small farmers' living conditions

Many small farmers in developing countries struggle with substandard living conditions. According to the UN's Food and Agriculture Organization (FAO), more than 475 million of the world's roughly 570 million farms are smallholdings, and half are in low and middle-income countries. Since around 80% of farms in IsDB countries reportedly cover less than two hectares and are therefore defined as smallholdings, agricultural output and thus the potential to generate income, is very limited.

Facing restricted access to markets, they have to sell their crops at a low price to middlemen who then sell them in bulk to processing firms. However, a lack of transparency often enables the middlemen to profit at the expense of the farmers whom their activity is supposed to benefit.

LEVERAGING DIGITAL SOLUTIONS TO RAISE EFFICIENCY AND INCREASE INCOMES

Putting innovative technologies to good use can augment small farmers' incomes and improve their overall living conditions. Though many farmers are already organized in cooperatives, inefficient data collection and validation makes these difficult and expensive to manage. New technologies and aspects of digitalization can simplify overhead processes and reduce complexity. A sustainable solution along these lines must therefore be implemented to lower administrative costs for farmers and improve cooperative efficiency. Farmers can then free up more resources to boost their own productivity and generate more income.

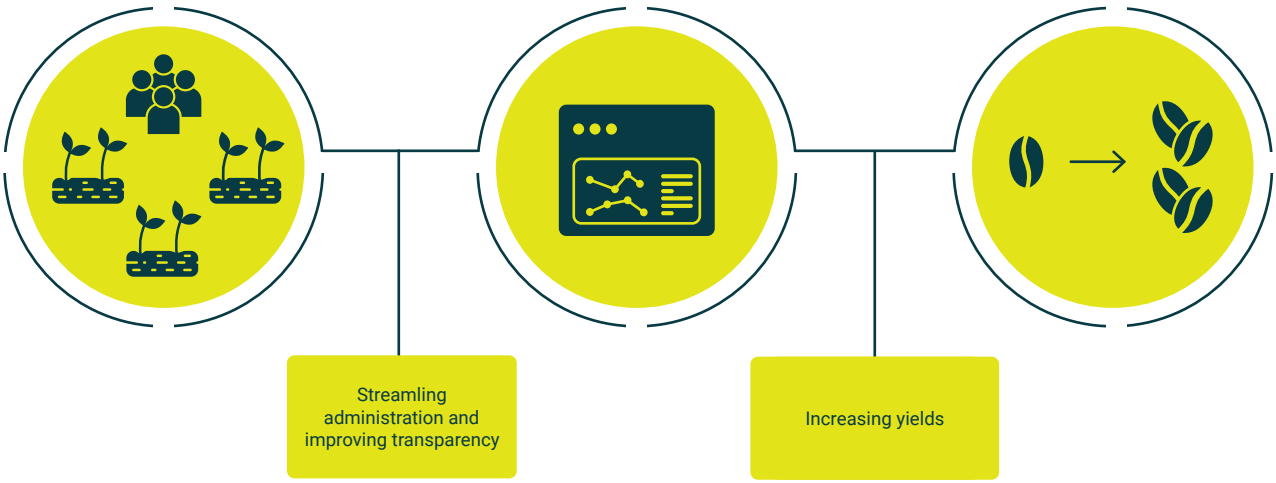
LEVEL OF KNOW-HOW AND PRECISE IMPLEMENTATION ARE CONSTRAINTS

Three main constraints nevertheless stand in the way of new digital solutions. Suitable knowledge and a commitment to implementation are crucial factors: Funding can get the technology imported, but local resources are the key to implementation. Players such as the Ministry of Agriculture and farm cooperatives are therefore pivotal in ensuring that products are used properly. Educational levels among farm workers themselves are the second constraint, as they must learn new skills to be able to work with the new technologies. Moreover, standardized solutions may need to be simplified to make them genuinely useful to a local workforce. A cooperative model can streamline the rollout of training and instruction, training just one person who is then responsible for using the technology and gathering data for a group of people. The third constraint is that even after training has been delivered, data accuracy will still be an issue. Wherever data is collected by different parties, collection practices must be standardized to avoid data contamination resulting from the misinterpretation of individual steps.

CASE STUDY – THREE-WAY COOPERATION BOOSTSCOFFEEFARMERS'INCOMESINUGANDA

An app streamlines administration, adds transparency and helps small farmers generate more revenue.

A project launched by software giant SAP, Germany's GIZ Society for International Cooperation and the Uganda Coffee Farmers Alliance (UCFA) has achieved remarkable success in leveraging innovative technologies to increase small farmers' incomes and thereby improve their overall living conditions. Small farmers with limited market access and low selling prices were the target group for the project's support. To counter this systemic disadvantage, the farmers had set up the UCFA to improve their negotiating position toward outside parties. Yet inefficient management and organizational processes bloated the Alliance's costs and undermined income potential. SAP therefore supplied a



proven software-based accounting system to streamline administration, while GIZ taught twelve UCFA managers how to use it to benefit the cooperative's farmers. Adapted for mobile phones and to meet local requirements, the software helped these managers record individual farmers' data – about coffee quantities, times and the location of individual farms. With each manager using one smartphone to keep records for about 650 farmers, the cooperative now has the data and transparency it needs to plan training and logistics more efficiently. Farmers have easier access to certifications and, from their own mobile phones, can receive the transfer of earnings in real time. Productivity rose sharply within a year, allowing members to supply 54,000 kg (1%) more coffee than in the preceding season. At the same time, 11% was shaved off administrative costs, leaving more money for the farmers themselves. The project was so successful that twelve more managers have since been trained: Nearly 30% of UCFA's members are thus covered by the new system. Another benefit is that the farmers also have access to loans and investment. While most were unable to provide the necessary collateral in the past, some banks have now begun to use the data collected with the app as proof of income. The project became a win-win situation: The farmers in Uganda benefited, but so too did SAP, which now has a successful reference project in the coffee sector to help it acquire further clients in sub-Saharan Africa and other developing regions.

OPPORTUNITIES FOR IsDB COUNTRIES – SIMILAR BENEFITS ACROSS ALL MEMBER STATES

Two very different countries illustrate how important this topic is to IsDB members. More than 80% of farms in Mozambique are smallholdings and nearly half the population lives in poverty. For them, this kind of innovation is crucial to optimize knowledge transfer and push up low incomes. Indonesia is at a completely different stage of development. It has raised its infrastructure and cultural stability to a moderately high level and is growing in importance every day. Yet Indonesia has a similar share of smallholder farmers as Mozambique – and it also has 26 million people of its own still living in poverty. Both countries – and many others – stand to benefit from initiatives that streamline administration and cut costs for smallholders. Imported digital and automation solutions can have a powerful impact on local farmers, while this momentum can be harvested to build lasting relationships with private sector players by giving them access to local markets.

4.1
KEY FIELDS OF ACTION
Targeting food security

In 2018, the UN's Food and Agriculture Organization (FAO) estimated that more than 820 million people throughout the world are undernourished. And as this report shows, certain IsDB member countries suffer a similar lack of **food security** or **food self-sufficiency.** The Global Food Security Index puts the number of such IsDB countries at 15, all of which are among the 30 lowest-ranking countries in the world in terms of the availability, affordability, quality and safety of food.

MECHANIZING SMALL FARMS TO BOOST YIELDS AND PRODUCTIVITY

Developing **agricultural mechanization** is one of several possible ways to raise a country's agri-food security level and develop a robust regional production base. Since small farmers play an important part in the value chains of IsDB countries' agri-food production, they can potentially play a key role in solutions to increase productivity and therefore enhance food security. In Morocco and Côte d'Ivoire, for example, small farms account for more than 60% of all farms. In Mozambique, the figure is above 80%. Across all these small farms, mechanization could improve productivity and yields, thereby enlarging the base of relevant agri-food stocks in each country. At the same time, such measures would support those sections of the population that are currently worst affected by the lack of food security.

ACCESS TO FINANCE AS A KEY CONSTRAINT

A lack of access to finance is one of the major hurdles for small farmers in IsDB countries. To drive mechanization, farmers need money to hire or acquire equipment that will help them generate more output and income. However, most banks are reluctant to engage with farmers who do not have sufficient collateral to back even small loans. Changing weather conditions and the seasonal nature of agriculture only add to the risk of default, making it difficult for banks to properly assess potential borrowers. Furthermore, the effort involved in assessing risks for single small farmers – indeed, in maintaining contact points with them in rural areas – is disproportionate to the potential returns on small loans.

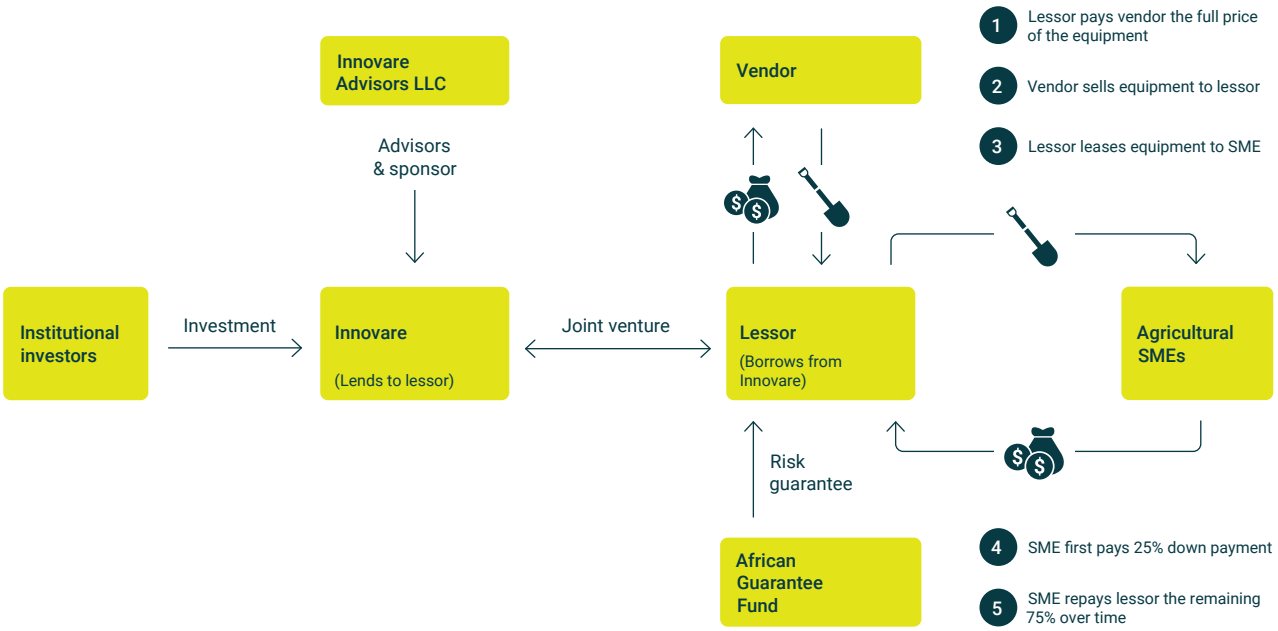
Farmer cooperatives and equipment leasing groups can be a good way to overcome these constraints. Lending to an organized group of farmers can mitigate the risk of default, while equipment providers can set up single points of contact that are commercially viable. Moreover, if development banks or other donors agree to guarantee such loans, the attraction to commercial partners is increased and the payback charges to borrowers are lowered.

CASE STUDY – COOPERATIVE LEASING MODEL MAKES MECHANIZATION AFFORDABLE

An innovative leasing model brings lenders, equipment providers and small farmers together to drive mechanization and improve productivity.

Several existing financial models are already helping finance the mechanization process described above. In collaboration with institutional investors and the African Guarantee Fund, Innovare, for one, has developed an equipment leasing model for small and medium-sized agricultural businesses. As shown in the illustration at right, money from Innovare's investors and advisory services is used to form a joint venture with a local lessor. The lessor receives the funds needed to buy agricultural equipment from different vendors, effectively pooling these purchases on behalf of a group of small businesses/farmers. These businesses/farmers are required to make a 25% down payment on the price of the equipment and then repay the

Innovative agricultural equipment leasing model



remaining 75% over a four-year period. The lessor is still the legal owner of the asset until full payment has been received.

For SME equipment costing more than USD 20,000 in total, all funding is sourced from commercial lenders such as banks and other capital market players. For volumes of under USD 20,000 (suitable for smaller operators, cooperatives and farmer organizations), subsidies can top up the funds sourced from capital market players. To attract private investors, competitive returns of between 7 and 12% are offered together with 155 to 200% asset backing in order to mitigate risks. According to the African Guarantee Fund's annual report and risk assessment, overall guarantees for up to USD 10 m are earmarked for the Innovare project.

In many areas, the key issue is that, while large companies have access to finance via the banks, SMEs and small farmers tend to struggle in this regard. For them, finance is either unattainable or prohibitively expensive (due to exorbitant interest rates). However, adopting the leasing models described above can empower even small farmers to mechanize and thereby drive further growth in output and productivity.

OPPORTUNITIES FOR IsDB COUNTRIES – REAPING THE BENEFITS OF PUBLIC-PRIVATE PARTNERSHIP

Given its huge potential to improve productivity and livelihoods along the agri-food value chain, mechanization should stay high on IsDB countries' agenda for the future. Commitment to developing national mechanization strategies should be a key to engaging directly with governments to consult on policies and regulations that support widespread implementation. Partnering with advisory firms and/or institutional investors to arrange funding and guarantees can then give farmers access to agricultural equipment. Leasing models such as the one in our case study could target producers of farm equipment in various IsDB countries. Building public-private partnerships in this way can thus free up resources to help improve local living conditions and productivity levels. But they can also foster collaboration between IsDB member states, cultivate synergies between individual countries and private sector players and create market opportunities for agricultural equipment producers.

4.1
KEY FIELDS OF ACTION
Developing sustainable agri-food production

Achieving sustainability stands out as one of the agri-food industry's stiffest challenges. The critical threat is the loss of biodiversity – caused by deforestation to make room for crop, feed and livestock production. According to World Bank figures, forests have shrunk by an area bigger than South Africa over the past 25 years. That works out at over 7.5 million hectares a year, or 27 soccer fields every minute of every day. Since they have a formidable presence in global agri-food production, IsDB countries must rise to the challenge, too, by establishing sustainable practices across different value chains.

IMPROVE LAND MANAGEMENT

One effective way to slow deforestation is to introduce control mechanisms. Setting up a unified land management system that registers all growers and provides a stream of up-to-date data about their farming practices (sustainable or otherwise) would be invaluable. By providing a high-level overview, the system would pinpoint specific areas where action is needed. Programs can then be launched to replant lost sections of forest and protect surviving areas, especially those vital to biodiversity.

ADVISE AND SUPPORT – BUT WISELY

To make such solutions feasible, several hurdles must be surmounted. The first is a lack of technical assistance and add-on services necessary to help farmers make the transition to sustainable agriculture. The second is the frequent lack of transparency about land titles, which sometimes exposes public or communal property to land grabs. Yet the creation of land registers, including validating registered farmland, is time consuming and requires intimate knowledge of local conditions. Without sensitivity to these issues, the mere act of registration and regulating could actually intensify conflicts over land and trigger violent property seizures.

CASE STUDY: FIGHTING DEFORESTATION IN BRAZIL'S SOY SUPPLY CHAIN

A modern forest management system fosters greater transparency – and slows the pace of deforestation.

Soy production is a staple of Brazil's farming sector and has, since 2012, nearly doubled in volume to roughly 40% of the country's total crop production. However, this rapid expansion poses a threat to the country's rich biodiversity.

One project to roll back deforestation, initiated by the United Nations Development Program (UNDP), aims to fight climate change by reinforcing sustainable management of natural resources and ensuring consistent policy implementation. In practice, this means setting up systems to help local farmers adopt sustainable farming practices. All farm properties that preserve native vegetation are registered in the system to facilitate monitoring and control. Since regular checks of all registered properties would require heavy investments, random checks may be a viable alternative – provided farmers see the penalties for non-compliance as a genuine deterrent.

Under the UNDP program, farmers are supplied with seeds and seedlings to cut the cost of reforestation. They are also trained in farm management and low-carbon techniques to minimize environmental impact. To bolster these measures, the program seeks to increase market demand for responsibly sourced soy and encourages the financial sector to promote sustainable soy by offering more favorable loan terms to registered farmers. So far, USD 35 m has been raised toward this goal: USD 7 m from the UNDP and USD 28 m in co-financing from public and private partners.

Of the 24,000 or so properties registered by early 2019, 50% have now been validated by environmental agencies. Proposals on how to remedy or offset shortcomings have been presented to about 25% of non-compliant properties (i.e. farms that violate protected areas or legal reserves). Over a three-year period, deforestation should be reduced by an estimated 1,000 km^2 in the affected region. Better monitoring, control and implementation of the new guidelines could double this figure by the time the project ends in late 2020. This approach gives Brazil a powerful tool to better control deforestation and foster more sustainable agricultural production.

OPPORTUNITIES FOR IsDB COUNTRIES – FROM FOLLOWERS TO FRONTRUNNERS?

The challenges posed by Brazil's soy industry are the same faced with every crop, feed product or animal produced in monoculture. In collaboration with the UNDP and several multinational players, the Indonesian government, for example, has launched the Sustainable Palm Oil Initiative to address similar problems in an industry of vital importance to its economy. Malaysia is another country that has recognized what is at stake and is eager to support similar projects. However, national programs may no longer suffice. It may be time to go a step further and embrace cross-border initiatives, tackling this global problem as a unified mission for the IsDB countries. The benefit of this approach would be to naturally encourage greater integration of producing industries in the IsDB member states into global value chains, establishing them as frontrunners on issues that will be shaping the agri-food sector.

4.1
KEY FIELDS OF ACTION
Building on production strengths and broadening processing

Several IsDB member countries are already strong on agri-food production and have thus achieved a moderate level of food security. For them, the next challenge is to begin moving up the global value chain by strengthening and broadening their primary and secondary processing capabilities. Expanding into lucrative processing activities will aid producing countries' economic development and cement their importance as serious global players across the agri-food value chain.

PARTNERING WITH GLOBAL PLAYERS AND ATTRACTING FOREIGN DIRECT INVESTMENT

While IsDB countries are already globally competitive in certain industries, there is undoubtedly room for improvement. As one leading European chocolate manufacturer recently noted, global players are increasingly interested in quality of production and the traceability of their product. And precisely these criteria are generally more transparent and compelling when primary-processed products are sourced from Western players rather than in developing countries. One way to bridge this gap is to partner with global processing companies and attract private foreign direct investment (FDI) into the countries of origin. This effectively integrates production with higher-value processing steps and boosts local output. Both funds and technological expertise thus flow into local markets, which in turn gain global credibility regarding the quality of their produce.

SUBSTANDARD GOVERNANCE FRAMEWORKS REPRESENT CONSTRAINTS

As always, certain obstacles must be overcome to make this happen. Substandard governance, a lack of government support and the non-involvement of civil society organizations are some reasons why private investors shy away from developing countries. Global players pin their hopes of a return on investment on good governance, so this is key. Private firms want protection under the rule of law. They want accountable partners, transparent operations and political stability. Host governments should also visibly combat corruption and commit to sustainability. Setting up investment subsidiaries and assistance services is therefore a good way to mitigate these risks and incentivize investors. This is important for first-time investors in particular, as many do not want direct links to domestic suppliers. The active involvement of local civil society organizations (such as farmers' collectives) is another essential factor to provide the necessary input factors and stable supply lines. Local education levels could also sometimes be an issue, although most processing investments run their own programs to teach workers the skills needed to operate and maintain processing activities.

CASE STUDY – SEEDING SUSTAINABLE DEVELOPMENT WITH FDI FROM INTERNATIONAL PLAYERS

Inward investment by Cargill and Nestlé is instrumental in advancing agri-food processing activities in Côte d'Ivoire and Mexico.

In 2019, Cargill announced plans to shift a larger share of global cocoa-grinding activities to sourcing countries by investing more than USD 113 m in Côte d'Ivoire and Ghana. Besides creating hundreds of new jobs at and around the processing plant in Côte d'Ivoire alone, this move will strengthen the local agri-food industry, drive economic growth at source and help build a sustainable business environment for small local farmers. In a separate announcement a year earlier, Nestlé committed to investing

USD 154 m in a new high-end coffee processing plant in Mexico, creating around 2,750 direct jobs (plus as many as 12,000 indirect jobs) and processing up to 20,000 tons of locally sourced green coffee a year. In the latter case, a state-of-the-art and fully sustainable processing factory will actively help Mexico meet several UN Sustainable Development Goals. In return, Nestlé asked the Mexican government to subsidize the planting of 80,000 hectares of coffee beans to further strengthen the local coffee sector. Clearly a significant development for Mexico's coffee industry and the country's agri-food contribution to GDP, this investment will also make the country much more competitive on a global scale in the long term.

In the short term, the benefits of FDI are often measured by the jobs it creates – a benefit that is taken for granted in international investments in agriculture. For example, a recent FAO study estimated that foreign direct investment in agriculture created more than 180,000 jobs in Ghana between 2001 and 2008. Yet the same study also showed how some investment led to the development of new infrastructure and improvements in existing infrastructure: either via the private companies' own direct investments, or as part of government commitments promised within the framework of the investment contract. The two examples shown clearly demonstrate how a policy of specifically attracting strategic investors can be leveraged to quickly industrialize and professionalize certain aspects of value chains – such as processing capabilities – with the aim of ramping up value-added services in sourcing countries.

OPPORTUNITIES FOR IsDB COUNTRIES – A FACILITATOR OF WIN-WIN PARTNERSHIPS

Foreign direct investment has already been instrumental in advancing projects to drive agricultural exports from countries like Egypt and Morocco. Such investments are now crucial to enable IsDB countries with moderate agri-food security to gain a solid foothold, establish sustainable standards and add more value in secondary processing. Cocoa and coffee in Indonesia and cocoa in Côte d'Ivoire would, for example, be ideal to attract such investment and operations.

In the space between governments and private companies, the IsDB can help facilitate this in a number of ways. For instance by using its experience to screen potential investors to guard against exploitation, facilitate knowledge/technology transfer, build necessary processing and export infrastructure and ensure high-quality investments that deliver lasting, value-added jobs. The network can also link up successful secondary processors in IsDB states (such as Pladis in Turkey) with relevant crop-producing countries (such as cocoa farmers in Côte d'Ivoire) – again creating lasting benefits for all parties.

Global cooperation in the agri-food sector

Collaboration between the public and the private sector is required to drive modernization in IsDB member countries' agri-food sectors

4.2
AN INVITATION TO COLLABORATE
Advantages of working with IsDB

The Islamic Development Bank equips people with the tools they need to build a sustainable future for themselves, their communities and their countries by putting the infrastructure in place to enable them to reach their full potential. Together with the private sector, IsDB sustainably drives modernization and growth within its member countries.

IsDB member countries include many of the fastest growing economies worldwide. Jointly, IsDB members represent the purchasing power of almost one quarter of the world's population. The combined GDP of IsDB members amounts to roughly USD 7 trillion. With GDP growth rates of up to 8% per year, they have considerable potential to further increase their market share in the global economy.

IsDB …

- **builds partnerships,** creating collaborative relationships between communities and nations by bringing together the public and private sector through public-private partnerships and joint project development
- **provides Islamic finance,** granting long-term sustainable and ethical financing structures as the global leader in Islamic finance to underpin project investments by issuing Sukuk (5-year Trust Certificates)
- **fosters innovation and sustainable solutions,** championing science, technology and innovation led solutions to meet the UN Sustainable Development Goals by boosting skills, sourcing ideas and transforming visions into real solutions through two main vehicles: the Engage Platform and the Transform Fund
- **develops high-potential markets,** investing in training, skill building and research and development so that member countries can generate and retain greater economic prosperity at home, raising the quality of their products and further integrating their value chains

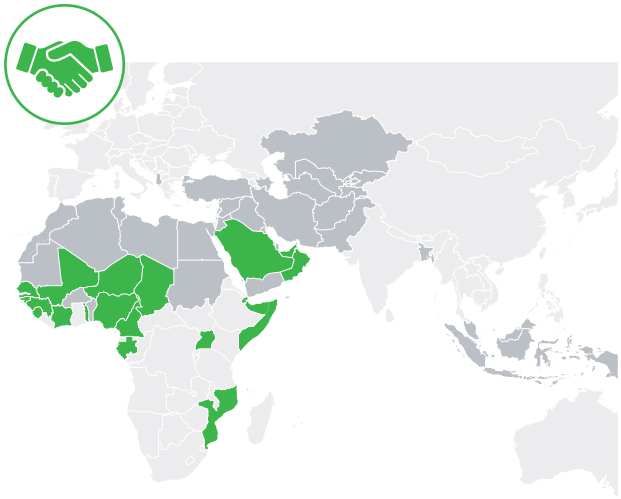
IsDB INVITES ITS PARTNERS TO COLLABORATE ON FURTHER DEVELOPING THE AGRI-FOOD SECTOR, …

- **providing them with access to IsDB's extensive network** of public and private sector representatives and **high-level decision-makers**
- jointly building up **skills and capacities** within IsDB member countries, granting partners long-term and sustainable **access to promising future markets**
- offering joint **project financing** as well as future **risk-sharing schemes** to mitigate investment-associated risks

4.2

AN INVITATION TO COLLABORATE

Examples of opportunities



To fully harness their potential for socioeconomic development, countries must seek to leverage their specific resources and competencies, while overcoming inherent barriers to growth. One way for IsDB members to do so is through cross-country partnerships. This section examines areas for future collaboration that are likely to result in win-win scenarios.

While some IsDB member states contain some of the world's most fertile agricultural land, others have virtually none and rely heavily on food imports. Even among those countries with large farm sectors, many lack the necessary know-how, inputs and infrastructure to boost output and productivity. To unlock this potential and move higher up the agri-food value chain, substantial investments are required. In production-focused countries, such outlays would create stable, more highly skilled jobs; in countries with little domestic production, investments to create capacity could significantly enhance food security.

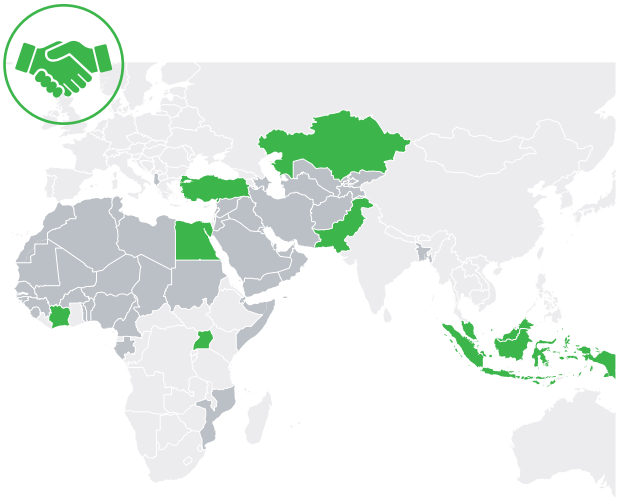
In all IsDB countries, initiatives designed to foster education and innovation can build competitive advantages in the agri-food sector, leveraging existing know-how to raise quality and accelerate the development of sustainable solutions.

New opportunities

One example of untapped potential is IsDB members like Bahrain, Oman, the UAE and Saudi Arabia, where less than 2% of the land area is considered arable. Here, alternative methods such as vertical farming and anti-desertification initiatives show tremendous promise but also require substantial investment.

Other regions, like sub-Saharan Africa, boast surplus land but lack the know-how and financial wherewithal to develop it. Here foreign direct investment could play a decisive role, as other IsDB member countries step in to help build output and export capabilities.

Through such partnerships, both parties can secure stable food supplies. The UAE, for example, has invested in agricultural projects in more than 20 countries, especially in East Africa, creating food and export "corridors" that secure future food supply, especially for staple goods such as rice. This example provides a showcase for further IsDB member states with limited production capacities, who can achieve higher food security by investing in arable land and production capacities in fertile IsDB member countries.



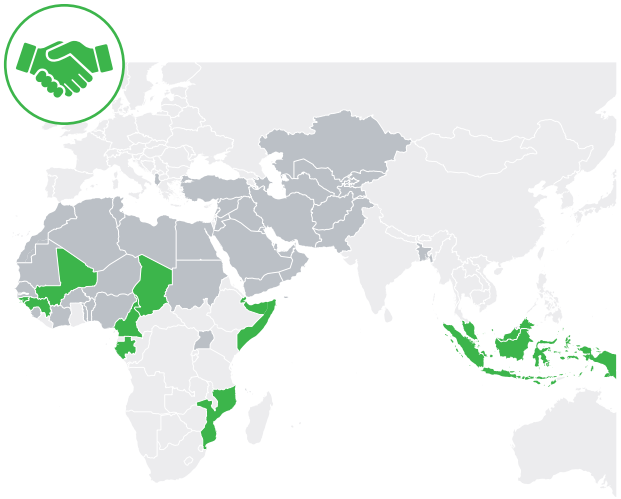
Developing agricultural excellence

IsDB member countries are among the world's top producers for luxury commodities such as cocoa and coffee, yet are weak in the more lucrative processing segment of these markets. A good way to break into this market niche is by sharing trade flows and knowledge with other IsDB countries.

Turkey, for example, already imports 78% of its cocoa beans directly from Côte d'Ivoire for domestic processing. Turkish conglomerates such as Yıldız Holding, which have already acquired valuable know-how in primary and secondary processing, could invest in upstream production back in Côte d'Ivoire – helping set up agricultural excellence centers on primary processing, quality and food safety standards.

The returns would flow both ways, as Turkish companies could negotiate attractive long-term contracts for high-quality cocoa butter and powder at lower prices – thanks to the impact of cheaper labor on processing costs in Côte d'Ivoire. For the producing countries, meanwhile, such investment would create more skilled jobs and value at home.

Other agri-food markets ripe for such cooperation include coffee, where producers like Uganda can draw on the processing experience of Malaysia and Indonesia, and the wheat and cereal sector, where exporters such as Kazakhstan and Pakistan can leverage Egypt's processing know-how.



Innovate together

Given their large and traditionally structured farm sectors, developing countries can benefit disproportionately from innovation. Cross-border innovation as well as the rapid adoption of modern technologies by IsDB countries can ramp up efficiency and output form the national and regional perspective. More advanced countries – like Indonesia, Turkey and Malaysia – can augment their knowledge base by applying cutting-edge techniques to new conditions (e.g. drier weather), while developing states – such as Somalia, Niger or Guyana – can benefit from well-established farming techniques.

Top-notch agriculture research universities in IsDB countries, like Universiti Putra Malaysia, can work with farmers who lack the technology to monitor soils and weather. By supplying sensors to smallholders, researchers would benefit from continuous data on climate change or the efficacy of various farming techniques, while farmers can use analysis of seed genetics, environmental conditions, weather and soil quality to increase yields and mitigate losses.

4.2
AN INVITATION TO COLLABORATE
Potential financing instruments for future collaboration

To achieve equitable growth and innovative development by 2030, a range of innovative financing instruments can be applied. Such instruments will facilitate collaboration between IsDB and its partners, unlocking significant investment opportunities for the private sector. Below, exemplary instruments are further detailed.

Debt instruments

Description

Small-scale farmers often lack sufficient collateral to access loans for mechanization or input factors. To bridge this financing gap, a fund is set up for a number of farmers, who then contribute a share of their revenues to the fund. The fund can then be used as collateral by each farmer

Potential for the private sector

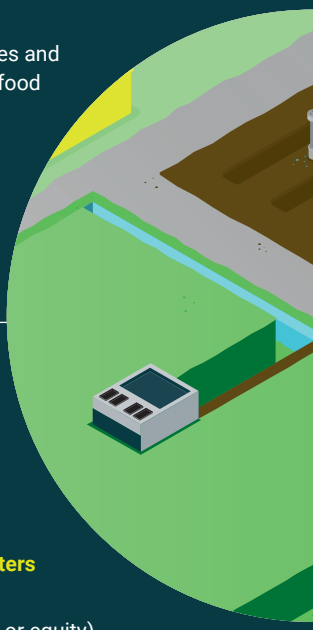
- Access to finance for smallholder farmers
- Minimized risk of loan default through peer screening
- Improved collaboration between smaller farmers and access to technology and innovation

Preferential interest rate schemes for agri-food machinery

Co-financing of feasibility studies and guarantees for pilot projects in agri-food

Post-harvest loan recovery for smallholder farmers

Mutual loan guarantee schemes for cooperatives



Innovative financing approaches

Description

Both large conglomerates and public institutions are lacking large-scale farm data for forecasts and innovation, while small farmers often lack access to data monitoring devices. Public players can bridge these gaps by co-financing data-sharing platforms and providing sensors to smaller farmers to collect and market anonymized data

Potential for the private sector

- Additional income streams for farmers
- Improved monitoring and data insights for small-scale farmers
- Reliable, anonymized data for innovation and research

Agri-food SME financing through stock markets

Crop and harvest insurance schemes

Sovereign data financing and shared data centers

Crowdfunding for new agri-food products (debt or equity)

Equity instruments

Result-based financing for crop diversification

Project finance for set-up of processing facilities

"Patient capital" for agri-food innovation

Blended finance for sustainability initiatives

Description

Development of new crops as well as new machinery often requires long innovation and production cycles before revenue can be generated. Agri-food specialized funds focused on long-term holding periods can close this access-to-finance gap

Potential for the private sector

- Access to long-term finance, incl. high-risk finance
- Higher degree of innovation through innovative start-ups
- Knowledge sharing through agri-food experts within funds

Combination of knowledge and capital

On-demand external agri-food expert pool

Financing of open innovation hubs and platforms

Financing of joint vocational education centers

Machinery lending pools

Description

In order to generate long-lasting innovation along the entire value chain, innovation platforms can incentivize cooperation and knowledge sharing among different players. Platforms should be provided free of charge by public parties to overcome systemic hurdles between small-scale farmers and large conglomerates and make cooperation attractive for all sides

Potential for the private sector

- Fostering of innovation along the entire value chain
- Reduced innovation and research costs
- Improved collaboration and knowledge sharing between different agri-food players

4.2 RECOMMENDATIONS

DOMESTIC MARKET POTENTIALS

SECTOR CAPABILITIES	Workforce qualification	**Improve workforce skills through vocational training** Emphasize training for smallholder farmers. Use co-financing to incentivize private sector cooperation; set up excellence centers for key
	Innovation	**Promote mechanization and modern farming methods** Modernization programs can provide smallholder farmers with funding to buy new input factors, as shown by Indonesia's BUN500 initiative
	Infrastructure	**Upgrade infrastructure to reduce wastage** Build basic infrastructure to guarantee uninterrupted supply chains, e.g. cooling facilities. Protect crops with rainwater basins, dams and levees
SECTOR COMPETITIVENESS	Value chain integration	**Build farmers' cooperatives** Increase scale by incentivizing agri-food cooperatives. Remove barriers through training and clear competition laws
	Productivity and scale	**Satisfy domestic demand** Prioritize productivity gains. Foster production of staples required for national food security
FRAMEWORK CONDITIONS	Governance & regulation	**Ensure stability to attract investment** Cultivate transparent, stable politics and the rule of law. Improve the ease of doing business. Provide reliable electricity supplies, including
	SDG contribution & sustainability	**Adopt regenerative farming** Disseminate knowledge regarding regenerative farming methods through information campaigns. Introduce waste-to-resource systems at farm-level to foster cooperation between plant- and meat-based farmers,
ACCESS TO FINANCE	Financing instruments	**Provide microloans and mutual loan guarantee schemes** Improve smallholders' access to finance via microloans. Create mutual guarantee schemes in cooperatives, thus generating shared collateral for loans

PRODUCTION-FOCUSED COUNTRIES

PRODUCTIVITY CHAMPIONS

production and processing skills. Establish field schools to instruct top farmers in key techniques to pass on to their neighbors. Focus on

regenerative farming, productivity enhancers (e.g. mechanization), and on-the-job training in advanced technologies such as drip irrigation

Encourage small farmers to form leasing pools that allow members of agri-food cooperatives to access equipment at low cost

Invest in digitalization and big data

Build innovation hubs and provide seed funding for agri-food start-ups. Brainstorm new ideas with private players. Invest in drones and sensors to collect real-time data for research

Speed up exports

Improve overland supply by rail and road investments. Optimize customs processes to speed up export times. Encourage shared infrastructure projects that merge energy and ICT networks to reduce cost

Invest in ICT infrastructure

Connect rural areas and farmers to the internet to provide online knowledge sharing and data exchange

Embrace international standards

Adopt international food safety and quality standards. Introduce close monitoring through an independent public control agency. Finance international certification for small and medium-sized farmers, using reputable labels such as UTZ

Diversify away from monoculture

Foster sustainable local production while moving away from exclusive reliance on traditional export commodities. Redirect high-value-added exports to Asia via targeted subsidies. Use public-private partnerships and tax incentives to attract private investment

through biogas projects that can use agricultural waste. Speed up import/export compliance procedures by digitalizing customs processes

Be open to innovation

Foster an innovation-friendly business environment by reliable intellectual property protection. Incorporate regulatory best practices/ industry norms for foreign direct investment

by using crop waste as animal feedstock, animal waste as fertilizer and having both shared by different farmers, for example. Provide microcredits and loans to foster resource-efficient drip irrigation systems.

Focus research on sustainable feedstock initiatives such as the use of algae and bacteria fed on gas

Attract FDI via incentives and guarantees

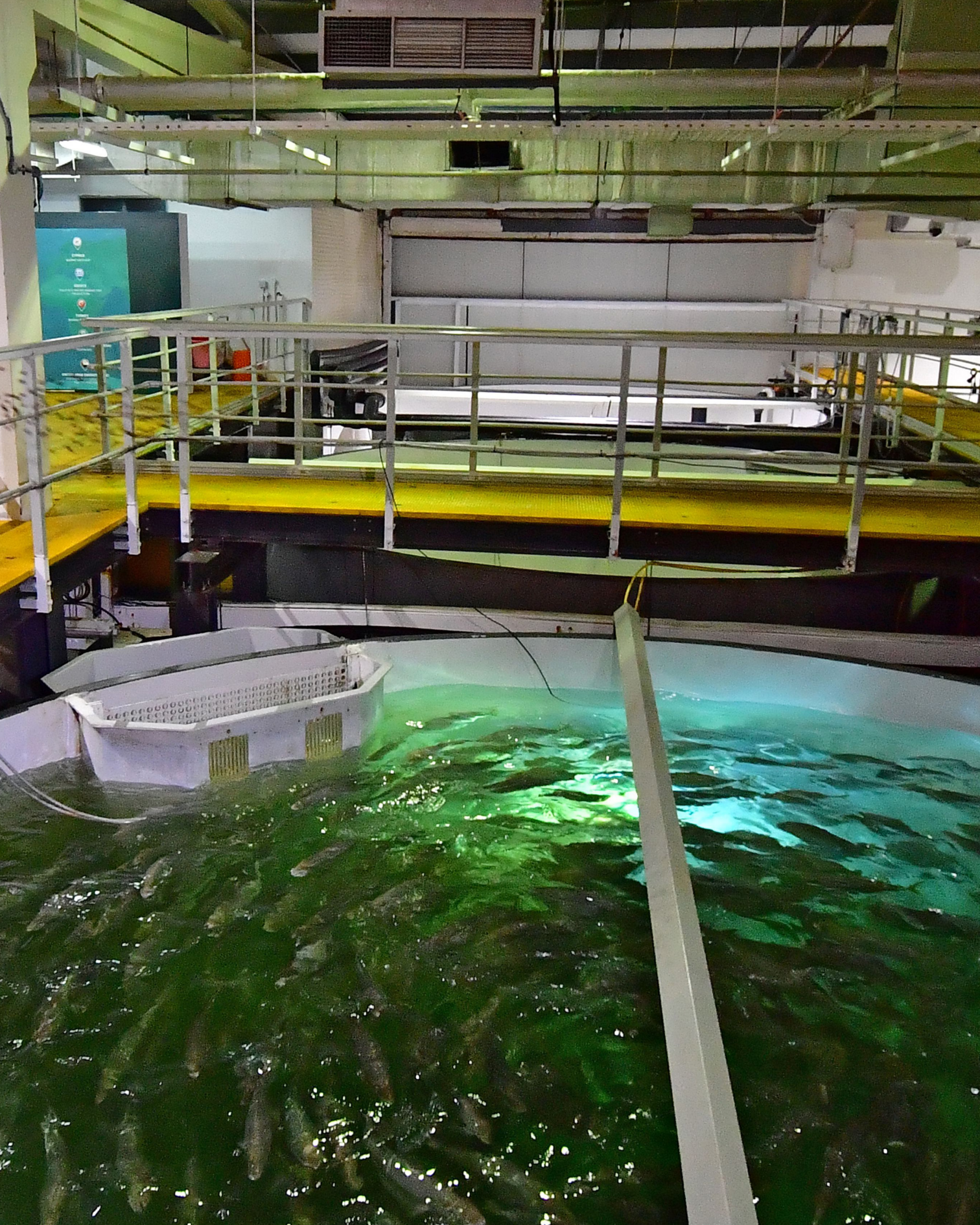
Incentivize global players in the agri-food sector to invest in large-scale production by offering investment guarantees to mitigate political or climate-related risks. Offer tax incentives such as full or partial tax holidays or rate reductions

Offer seed funding for start-ups

Use seed funding and open competitions to encourage for innovative start-ups

Feeding the fish in an indoor aquaculture fish farm

Technological innovation can expand the boundaries of food production. Bader bin Mubarak, chief executive of Fish Farm, throws food pellets into the tank at a fish farm facility in Dubai



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This publication is led with extensive contribution from **Ahmet Enes Demirhan,Dr Mohammed Faiz Shaul Hamid** of the GVC Section, Department of Strategy and Transformation (DoST), **Dr Ahmed Elkhodary,** Director of DoST and **Dr Bandar Hajjar,** President of IsDB. This publication covers a wide range of complex topics and incorporated content from multiple stakeholders including IsDB staffs, IsDB Member Countries, United Nations bodies, various agencies and industry experts. We thank all of the organizations whose knowledge of the industries and related subjects has informed this publication. This brings many insights into the global challenges of multilateral development banking in the twenty- first century.

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