# Barriers to an Enabling Environment in Start-Up Acceleration in Fragile and Conflict-Affected Settings in Jordan and Nigeria

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**CGIAR Initiative on Fragility, Conflict, and Migration**

The CGIAR Initiative on Fragility, Conflict, and Migration aims to enhance the resilience of food, land, and water systems in fragile and conflict-affected settings, where migration-related challenges are prevalent. By taking a systems approach and working in partnership with local stakeholders, the initiative seeks to generate evidence to inform effective policies and programs that promote social and gender equity, climate resilience, conflict mitigation, and peacebuilding in these settings.

Learn more about the initiative here: https://www.cgiar.org/initiative/fragility-conflict-and-migration/



Cover Photo: Za'atari Refugee Camp Jordan. Lynsey Addario/New York Times

# Contents

**Executive Summary** ..... **4**

**1. Introduction** ..... **5**

**2. An Overview of Business Climate in Jordan and Nigeria** ..... **6**

2.1 Jordan ..... 6

2.2 Nigeria ..... 7

**3. Findings** ..... **9**

3.1 AquaPoro Jordan - Extracting Water From Air ..... 9

3.2 iPlant Jordan - A Vertical Farming Revolution ..... 15

3.3 Koolboks Nigeria - Renewable Solutions for Cooling ..... 18

**4. Conclusion and Recommendation** ..... **21**

**5. References** ..... **23**

# Acronyms and Abbreviations

| | |
|---|---|
| **AfDB** | African Development Bank |
| **CBOs** | Community-Based Organizations |
| **CGIAR** | Global Research Partnership for a Food-Secure Future |
| **EC** | European Commission |
| **EEA** | European Environment Agency |
| **EU** | European Union |
| **FAO** | Food and Agriculture Organization |
| **FCM** | Fragility, Conflict, Migration Initiative |
| **GDP** | Gross Domestic Product |
| **GIZ** | German Corporation for International Cooperation |
| **IFC** | International Finance Corporation |
| **IMF** | International Monetary Fund |
| **IWMI** | International Water Management Institute |
| **JIACC** | Jordan Integrity and Anti-Corruption Commission |
| **LED** | Light Emitting Diode |
| **MENA** | Middle East and North Africa |
| **OECD** | Organisation for Economic Co-operation and Development |
| **O&M** | Operation and Maintenance |
| **PEBEC** | Presidential Enabling Business Environment Council |
| **PPP** | Public-Private Partnerships |
| **PSI** | Pioneer Status Incentive |
| **SDG** | Sustainable Development Goal |
| **SMEs** | Small- and Medium-Scale Enterprises |
| **SEforALL** | Sustainable Energy for All |
| **UN** | United Nations |
| **UN DESA** | United Nations Department of Economic and Social Affairs |
| **UNEP** | United Nations Environment Programme |
| **UNHCR** | United Nations High Commissioner for Refugees |
| **VAT** | Value Added Tax |
| **WFP** | World Food Programme |
| **WIT** | Water Innovation Technologies Program |

# Executive Summary

The enabling environment is a critical driver of business acceleration, particularly in sectors essential for sustainable development, such as agriculture, food, and water security. In Africa and the Middle East, these sectors underpin economic stability and livelihoods, yet businesses face numerous challenges that impede their ability to scale and innovate. A supportive enabling environment—comprising policy frameworks, institutional structures, access to finance, infrastructure, and market systems—plays a decisive role in overcoming systemic barriers such as food insecurity, climate change, and resource scarcity. However, structural weaknesses, fragmented markets, limited access to capital, and governance challenges continue to hinder the scaling of sustainable enterprises in these regions.

This paper examines the enabling environment for business growth in fragile and conflict-affected contexts through the lens of three enterprises: AquaPoro (Jordan), iPlant (Jordan), and Koolboks (Nigeria). These SMEs, selected under the Stability-and-Peace Accelerator Program run by the World Food Programme in partnership with CGIAR's Fragility, Conflict, Migration Initiative, are pioneering innovative solutions in water harvesting, vertical farming, and solar-powered refrigeration, respectively. Despite their potential to drive transformative change, they face significant regulatory, financial, and operational barriers that limit their ability to expand.

Key findings reveal that AquaPoro encounters bureaucratic inefficiencies, regulatory opacity, and reliance on informal networks (*wasta*) in Jordan's water sector. Policy reforms promoting transparency, financial incentives for water technology, and improved regulatory clarity could facilitate its growth. iPlant highlights the need for updated agricultural policies that recognize agritech innovations. High import tariffs and energy costs challenge its expansion, necessitating tax benefits, streamlined customs procedures, and enhanced financing mechanisms. Meanwhile, Koolboks in Nigeria struggles with various challenges, including customs delays, limited financing options, and security concerns in fragile regions. Addressing these issues through regulatory simplifications, targeted financial incentives, and strategic partnerships could enhance its market penetration and impact.

To create a more conducive business environment, policymakers must prioritize regulatory transparency and reform, financial incentives and access to capital, market and infrastructure development, and public-private partnerships (PPPs). Reducing bureaucratic barriers, expanding funding opportunities for SMEs, strengthening distribution networks, and fostering collaboration between governments, international organizations, and the private sector are essential strategies for enabling sustainable enterprises to scale.

By addressing these systemic challenges, African and Middle Eastern economies can unlock the full potential of sustainable enterprises, fostering economic inclusion, climate resilience, and long-term food and water security. This paper underscores the urgent need for targeted interventions that bridge policy-practice gaps and catalyze innovation in fragile and conflict-affected settings.

# 1. Introduction

The enabling environment plays a pivotal role in driving business acceleration, particularly within sectors crucial for sustainable development, such as agriculture, food, and water security. In Africa and the Middle East, where these sectors form the backbone of many economies and are integral to the livelihoods of millions, creating a conducive environment for business growth is both a necessity and an opportunity. The enabling environment encompasses a combination of policy frameworks, institutional structures, access to finance, infrastructure, technological innovation, and market systems that collectively determine the ease and efficiency with which businesses can operate, scale, and thrive (World Bank 2020). For agriculture, food, and water security, this environment directly influences the capacity of enterprises to address systemic challenges such as food insecurity, climate change, and resource scarcity while fostering economic growth and resilience (FAO 2021).

Both Africa and the Middle East face unique challenges and opportunities that underscore the importance of a robust enabling environment. Africa, home to a rapidly growing population projected to double by 2050, grapples with immense pressure on food systems and water resources (UN DESA 2019). Similarly, the Middle East faces acute challenges of water scarcity, desertification, and dependency on food imports, exacerbated by climate change (UNEP 2020). Despite these hurdles, both regions possess vast natural resources, a rich history of agricultural innovation, and an entrepreneurial spirit that, if effectively harnessed, can drive transformative change (AfDB 2021). However, realizing this potential requires addressing structural barriers, such as inadequate infrastructure, fragmented markets, limited access to capital, and weak governance systems, which often stifle innovation and productivity. Moreover, fragile and conflict-affected states in these regions face additional challenges, including political instability, disrupted markets, and the displacement of communities, making establishing a resilient and enabling business environment even more critical (World Bank 2022).

In fragile and conflict-affected states, the enabling environment assumes heightened importance as it serves as a foundation for rebuilding economies, restoring livelihoods, and fostering stability. Policies and interventions tailored to such contexts must prioritize inclusivity, resilience, and adaptability, ensuring that businesses can not only survive but also contribute to recovery and growth (OECD 2020). For agriculture, food, and water security, this includes fostering partnerships between governments, development organizations, and the private sector to address immediate needs while laying the groundwork for long-term sustainability. Investment in infrastructure, market access, and innovative financial solutions are key elements that can transform challenges into opportunities, even in the most fragile settings (IFC 2021).

This paper explores the critical role of the enabling environment in accelerating business development in agriculture, food, and water security across Africa and the Middle East. It draws from a case study approach and reports on the gaps, weaknesses, uncertainties, and opportunities faced by three SMEs (start-ups) that operate businesses in fragile- and conflict-affected settings in Jordan and Nigeria. These SMEs are AquaPoro Jordan, harvesting water from the air in arid areas and refugee camps; iPlant Jordan, leading a renewable vertical farming revolution; and Koolboks Nigeria, offering solar-powered cooling storage opportunities to marginalized groups. These SMEs are selected under the Stability-and-Peace Accelerator program based on their investor readiness and the impact potential of their innovations around addressing food, water, and energy crises in volatile regions. The accelerator program is run by the World Food Program (WFP)'s Innovation Accelerator in partnership with the International Water Management Institute (IWMI), representing CGIAR's Fragility, Conflict, and Migration Initiative.

By examining the interplay between policy and practice and highlighting successful and needed interventions, this report underscores the need for collaborative efforts to address the gaps. Such collaboration can create supportive business ecosystems that are able to catalyze inclusive growth, enhance business resilience, and ensure environmental sustainability and climate change adaptation in sectors vital for agriculture, livelihoods, and the economy. The following sections provide an overview of the business climates in Jordan and Nigeria based on a literature review, especially drawing from the World Bank's Ease of Doing Business Report (2020), and unpacks the data collected through interviews with the SME founders and other staff against this background, shedding light on these policy-practice interplays and interventions.

# 2. An Overview of the Business Climate in Jordan and Nigeria

### 2.1. Jordan

Historically, Jordan faced numerous challenges that hindered its business climate. The crises in the Middle East and North Africa (MENA) region take a toll on Jordan's economy. The First National Voluntary Review on the Implementation of the 2030 Agenda acknowledged that the influx of Syrian refugees and ongoing regional crises stretched Jordan's resources to their limits, impacting various aspects of life (Kingdom of Jordan 2015). These challenges have led to increased security pressures, higher budget costs, limited economic growth, rising unemployment and poverty, and declined exports due to border closures and loss of transit trade. Ongoing geopolitical developments continue to affect investor confidence, tourism, and public finances, posing risks to sustainable development and social cohesion. In response to these challenges, Jordan committed to targeted, comprehensive reforms over the last decade to propel its economic resilience and prosperity. Despite the regional threats, Jordan is positioned as a stable country in a fragile region, which makes it a strategic hub for international business, prompting authorities to improve competitiveness.

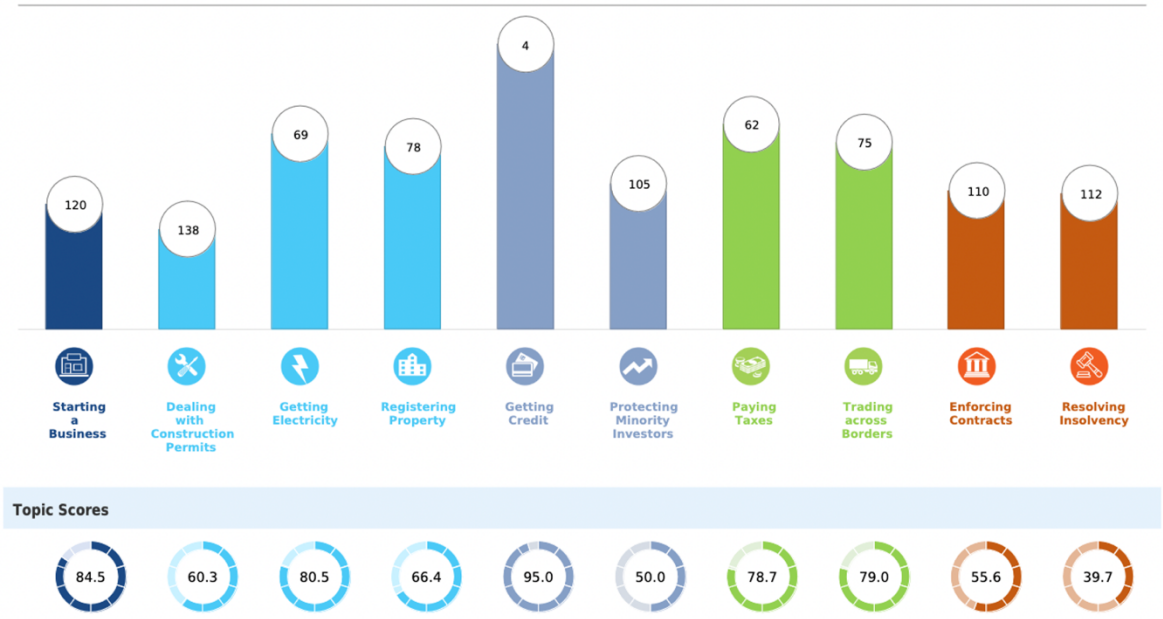
Jordan has made significant strides in enhancing its enabling business environment and received funding and technical assistance from international organizations such as the World Bank and the International Monetary Fund (IMF), contributing to this progress. It has pursued ambitious structural reforms under the Jordan Vision 2025 strategy, focusing on private sector growth and investment while maintaining fiscal stability with IMF support (Kingdom of Jordan 2015). Jordan introduced the Jordan Economic Growth Program (2018-2022) to focus on inclusive growth amidst regional turbulence. This includes structural and business reforms across key sectors like human resources, energy, and entrepreneurship, alongside crucial investment opportunities and a capital expenditure program that fosters Public-Private Partnerships (PPPs). In a speech, the former Prime Minister declared that Jordan adopted a new generation of economic laws to enhance investment, business environment, and competitiveness, such as the new Public-Private Partnerships Law, new Tax Law, and a new Electronic Transactions Law. Parliament is also deliberating a new Secured Lending Law, and work is underway on a new Bankruptcy and Insolvency Law (Kingdom of Jordan 2015). In 2022, Jordan enacted the Investment Environment Law, aiming to streamline investment procedures and enhance the role of the Ministry of Investment as the primary authority for both local and foreign investments. This legislation is part of broader efforts to foster a more conducive environment for business operations (U.S. Department of State 2024).

In the World Bank's *Ease of Doing Business* report (2020), Jordan ranked 75th out of 190 economies, a sharp improvement from its 104th position in 2019 (Figure 1). This 29-spot jump underscored Jordan's status as one of the top three global improvers, alongside Saudi Arabia and Togo. The progress was driven by reforms in three key areas.[1] Firstly, Jordan excelled in creating a conducive environment for *getting credit*, scoring 95/100 and ranking 4th globally—on par with advanced economies like the United States and Australia. Key changes included (1) establishing a unified legal framework for secured transactions, providing clarity and confidence to lenders and borrowers, (2) launching a centralized, notice-based collateral registry, simplifying the use of movable assets as loan collateral, and (3) introducing credit scoring systems via private credit bureaus, making it easier for banks, financial institutions, and individuals to assess creditworthiness. Second, under the *registering property* category, modernizing its insolvency laws granted Jordan 78$^{th}$ rank globally, focusing on facilitating market exits for unviable businesses to reduce economic inefficiencies and allowing reorganization and restructuring for financially distressed but viable firms, enabling them to recover and contribute to the economy. These changes increased investor confidence as businesses gained clearer pathways for managing financial difficulties. Third, under the *paying taxes* category, tax reforms aimed to reduce the administrative burden on businesses by implementing electronic filing

[1] In the Ease of Doing Business Index of the World Bank (2020), countries score points in ten categories of topics, namely, starting a business, dealing with construction permits, getting electricity, registering property, protecting minority investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency.

and payment systems for labor taxes and other mandatory contributions, and reducing the number of annual tax payments, making compliance less time-consuming and more cost-effective (World Bank 2020).

Figure 1. Rankings on Ease of Doing Business Topics in Jordan




Source: World Bank (2020)

Despite these notable achievements, Jordan continues to face challenges in other areas where improvements need to be made. Jordan scored lowest in dealing with construction permits (ranked 138$^{th}$), which remains lengthy and costly, with complicated regulatory requirements. In starting a business (ranked 120$^{th}$), entrepreneurs face significant bureaucratic hurdles, including numerous procedural steps and high costs. In enforcing contracts (ranked 110$^{th}$), judicial efficiency is still a bottleneck, with disputes taking considerable time and resources to resolve. These areas highlight the need for further streamlining regulatory frameworks and infrastructure to support businesses, particularly for small and medium enterprises (SMEs). Jordan's trajectory reflects a commitment to improving its investment climate, making it an increasingly attractive destination for businesses and investors. However, sustained efforts and targeted reforms in key areas will be essential to maintain and build on this momentum. The focus for future reforms should include enhancing transparency and reducing bureaucratic inefficiencies, investing in digital transformation to modernize government services, and expanding support for SMEs, which represent a significant portion of Jordan's economy.

While significant strides have been made, particularly in legislative reforms and climate finance, challenges such as favoritism (wasta) and sector-specific constraints persist. Wasta is a deeply ingrained socio-cultural phenomenon that influences almost every aspect of Jordan's business environment. While it provides certain benefits in navigating complex bureaucratic systems, its overall impact on market efficiency, meritocracy, and foreign investment is negative. Efforts to mitigate favoritism through reforms, education, and cultural shifts are essential for fostering a fairer and more transparent business climate in Jordan. Ongoing efforts to address these issues are essential for creating a more transparent, equitable, and attractive environment for both local and foreign investors.

### 2.2. Nigeria

Nigeria's business climate is at a pivotal juncture, with recent reforms laying the groundwork for potential economic stabilization and growth. In May 2023, Nigeria implemented bold macroeconomic reforms to stabilize and stimulate growth. Notably, the government substantially eliminated the gasoline subsidy and unified the exchange rate as market-reflective, effectively removing the parallel market premium. These measures are

anticipated to generate significant fiscal and economic benefits. The International Monetary Fund (IMF) forecasts a growth rate of approximately 3% for Nigeria in 2023, while the Nigerian government projects a more optimistic 3.8% growth rate (World Bank 2020; U.S. Department of State 2023). However, persistent structural challenges and a substantial climate finance gap necessitate continued policy interventions and investments.

Despite the reforms, Nigeria continues to face structural economic challenges. Over the past seven years, the country experienced two economic recessions, with GDP growth averaging 1.1% during this period. Unemployment and underemployment rates reached a combined 56.1% in 2020, contributing to 133 million Nigerians living in multidimensional poverty. Economic activities have increasingly shifted towards agriculture, which expanded from 23% of GDP in 2015 to 26% in 2021, while the manufacturing sector declined from 9.5% to 9% in the same period. This shift underscores the need for structural transformation to enhance productivity and economic resilience (Brookings 2023).

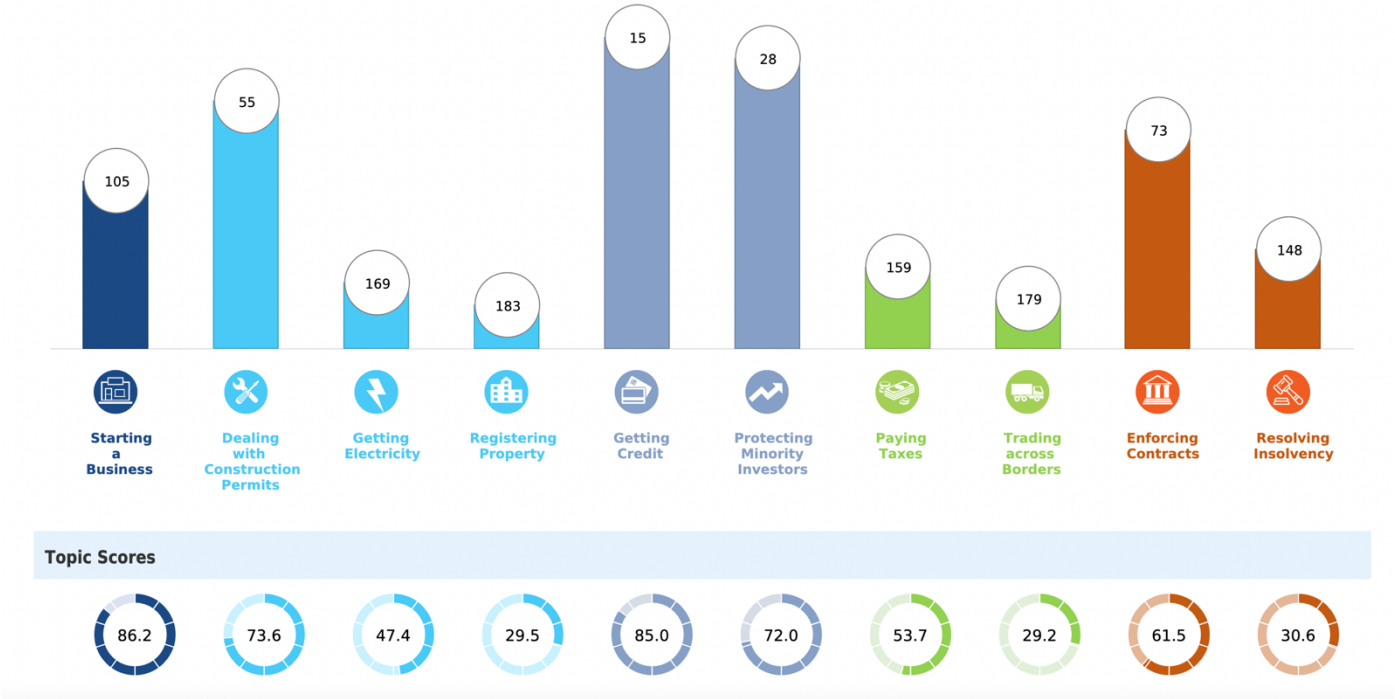
Addressing climate change is also crucial for Nigeria's sustainable economic development. In 2021/22, the country attracted USD 2.5 billion in climate finance, marking a 32% increase from USD 1.9 billion in 2019/20. Despite this growth, there remains an annual climate finance gap of USD 27.2 billion, as the estimated need is USD 29.7 billion annually until 2030. Public actors provided 70% of the climate finance, with multilateral development finance institutions contributing USD 1.2 billion. Private sector participation also increased, accounting for 30% of the total climate finance, with corporations leading private investments, particularly in small-scale solar photovoltaic projects (CPI 2024).

Nigeria’s performance in the World Bank's Ease of Doing Business Index reflects the country’s commitment to improving its business climate. Nigeria's reform initiatives have targeted key bottlenecks, making it one of the top global improvers alongside Togo, ranking the country 131st out of 190 countries, with significant progress compared to previous years (World Bank 2019; 2020) (Figure 2). The key areas of improvement are recorded in three categories as follows:

- To provide improved support for *starting a business*, Nigeria streamlined the process by reducing the time and number of procedures involved. This streamlining was achieved through initiatives such as online business registration portals operated by the Corporate Affairs Commission, which simplified processes for entrepreneurs, and the removal of redundant procedures and better coordination between government agencies.
- Nigeria enhanced *access to credit* by strengthening credit reporting systems, including the inclusion of data from utilities and retailers in credit bureau reports, and expanding the coverage and availability of credit information for borrowers, which boosted transparency and improved lenders’ decision-making processes. These changes reflect Nigeria’s commitment to providing an enabling environment for businesses reliant on access to finance (World Bank 2019).
- The country implemented significant measures to facilitate trading across borders by introducing joint inspections to streamline export and import processes, enhancing the functionality of its electronic platform for submitting customs documentation, and reducing port congestion through better management of cargo movement. These improvements reduced both the time and cost of trading across borders, making it easier for businesses to engage in international trade (World Bank 2019).

Despite this progress, critical challenges remain, as illustrated in Figure 1, and more comprehensive measures are required for sustained growth and competitiveness. Three key challenges are faced in the areas of, firstly, *getting electricity*: obtaining reliable electricity connections remains a significant obstacle. Businesses often face frequent power outages, while high costs for backup electricity increase the cost of operations. Reliability of supply and transparency of the tariff index are low, followed by complicated procedures such as the very long time needed from submitting an application to the installation of meters and electricity flow—three to four months on average (World Bank 2020). Second, the process of *enforcing contracts* by resolving commercial disputes in Nigeria is time-consuming, with cases often taking years to conclude, and costly, with high legal and procedural fees discouraging both local and foreign investment (World Bank 2020). Third, the process of registering property remains complicated due to cumbersome bureaucratic procedures, high costs, and lack of transparency in land administration (World Bank 2020).

Figure 2. Rankings on Ease of Doing Business Topics in Nigeria




Source: World Bank (2020)

To address the constraints faced by businesses in Nigeria, the Presidential Enabling Business Environment Council (PEBEC) was established in 2016. Key achievements under PEBEC include (1) automation of business processes, such as tax filings and business registration, (2) implementation of a National Action Plan, which focuses on reducing bureaucratic red tape and fostering private sector growth, and (3) the development of the Ease of Doing Business Reform Tracker, a tool to monitor and assess progress across various sectors (PEBEC 2020). The establishment of PEBEC and targeted policy interventions provide a strong foundation for continued reform. With sustained commitment and innovative approaches, Nigeria has the potential to further enhance its business environment and attract greater domestic and foreign investment.

Nigeria's efforts to reform its business environment have yielded positive results, as evidenced by its improved ranking. Reforms in starting a business, access to credit, and trading across borders have significantly enhanced the country's global competitiveness. However, addressing persistent issues such as electricity reliability, contract enforcement, and property registration is essential for sustaining this progress. While innovations such as Koolboks Nigeria offer solar energy solutions to small businesses for electricity shortage and unreliability, sustained efforts are required to tackle remaining challenges and ensure a conducive environment for such private-sector-led innovations to develop and scale such sustainable solutions, as well as the overall business growth and investment.

# 3. Findings

### 3.1. AquaPoro Jordan—Extracting Water from Air

Globally, water resources are being depleted faster than replenished, and water quality issues are increasing. This is specifically an issue in Jordan, the world's second most water-scarce country (UNHCR 2024). To address water scarcity and quality problems, AquaPoro, a Jordan-based start-up, commercializes the revolutionary water

harvesting (WaHa) technology that harvests water from the air. This revolutionary innovation, developed by scientists at the University of California Berkeley, utilizes Metal-Organic Frameworks to extract water from the air, even in arid conditions. These are highly porous materials that selectively adsorb and capture various chemical compounds, including the water vapor in the air (ENI CBCMED 2018). Once the material becomes saturated, the water is released by reducing the relative vapor pressure, and then the released vapor is condensed to produce liquid water (ENI CBCMED 2018). The device repeats this process multiple times daily to maximize water production. Some devices use an external solar-powered energy source to drive this process, which is an added benefit. Thus, in addition to creating water from the air, WaHa users can simultaneously overcome power supply challenges in remote or rural areas.

AquaPoro has developed two devices deploying this technology. Based on the interviews with the start-up, the primary and, thus far, the successfully commercialized device is for domestic use: a portable device mounted on the wall and works on a 120V outlet or a low-current 240V circuit, easy to set up and run. It also can be connected and run on a renewable energy source. No expensive electrical upgrades and highly specialized installation are needed. With a plug-and-play approach, an intuitive user interface, and only two user touch points for maintenance (air filter and mineralization column), it is simple. WaHa's total power rating peaks at 0.74 kW, which means it is energy efficient and does not strain the electricity bill, the grid, or the electrical panel, in addition to cost savings to households on water.

The innovation supported by the WFP and CGIAR selected under the Peace-and-Stability Accelerator is called Mega-WaHa—an evolution of WaHa with a similar technology in abstracting water from the air but a much larger capacity for agriculture. While the regular WaHa produces about 18-20 liters daily, Mega-WaHa can make and store about 500 liters. A prototype has been designed and is currently being tested south of Amman, which will be followed by pilot testing on a farm by the beginning of 2025 and then manufacturing for initial customer orders. Mega-WaHa is a research and development project based on the principles of WaHa as a mature product tested and commercially successful, although it is ambitious to be more efficient than WaHa. It does not only offer a solution to the water problem by extracting water from the air but also allows the use of solar energy with a renewable energy upgrade.

AquaPoro is motivated by the ambition to redefine water access and delivery, promote water independence, and catalyze the transition to a more sustainable future. By commercializing (Mega-) WaHa, AquaPoro supports Jordan in achieving Sustainable Development Goal (SDG) 6: Clean Water and Sanitation. Furthermore, the project aims to create employment opportunities and provide high-value mentorship in research and development, particularly benefiting Jordan's educated and highly skilled youth. This aligns with SDGs 4: Quality Education and 8: Decent Work and Economic Growth. Lastly, the project emphasizes the importance of transdisciplinary research and innovation, bringing together experts from various fields, such as chemistry, materials science, and chemical, mechanical, and electrical engineering. This contributes to Jordan's progress towards SDG 9: Industry, Innovation, and Infrastructure (ENI CBCMED 2023). Both types of water harvesters are installed in conflict areas and provide safe drinking water and the other impact benefits to conflict- and crisis-affected communities.

WaHa has already garnered significant attention from development organizations for its benefits in fragile- and conflict-affected settings. One example is a purchase by the International Rescue Community (IRC), which installed WaHa in the Za'atari refugee camp and indicated interest in setting up more devices in other camps and countries. Za'atari refugee camp, situated in the arid northeast of Jordan, opened in 2012, is home to 80,000 Syrian refugees today—the largest refugee camp in the Middle East and one of the largest in the world (UNHCR 2024). More than 643,000 of millions of Syrians and 74,000 from other countries fleeing civil war are in Jordan, as estimated by the European Commission (2024a), inhabiting rows of tents and trailers in overcrowded refugee camps where food and water supplies are short. Humanitarian agencies have built tents, roads, schools, and hospitals to meet their needs, and small shops and businesses started and run by the settlers. More than 32 different UN agencies and NGOs work in this camp, providing health services, cash assistance, and shelter maintenance, among other services. UNHCR reported that despite the camp's history of water shortage over a decade, the problem has not yet been resolved: a survey showed that 30 percent of households do not have adequate water access, although all shelters are connected to a water network. The existence of several humanitarian agencies and NGOs in the camp presents an opportunity for scaling the (Mega-) WaHa innovation to address the water and associated food and health problems.

Interviews with AquaPoro founders identified several bottlenecks related to the enabling environment that the start-up encountered. These issues significantly align with the results of the World Bank's Ease of Doing Business 2020 analysis. The findings are presented in associated thematic categories as follows:

### Getting Credit, Paying Taxes, and Financial Incentives for Sustainable Enterprises

A lack of financial incentives, such as tax exemptions, for start-ups in a high-tax country like Jordan and a lack of clear regulatory information by the state pose uncertainties and high costs for sustainable enterprises and for their potential to scale water solutions for the country's need. In Jordan, the government offers tax exemptions as financial incentives and subsidies to encourage business and business-led economic development and implements measures to cope with the country's water scarcity as an arid country. Public spending on the environment is less than 0.5 percent of the government budget, and a greater amount of public financial resources is necessary, including through fiscal reforms (UNEP 2020). Moreover, this does not apply much to some sectors. Historically, most financial incentives in Jordan are directed toward groundwater extraction, which supplies most of the rural and urban supply and consumption.

The success of scaling sustainable water innovations in Jordan must be contextualized in groundwater policies and politics in an arid country where it remains the primary source of water supply. Groundwater is a crucial resource for Jordan since surface water is fully used and as a strategic reserve to withstand potential dry spells. Therefore, controlling its use is perhaps more critical in Jordan than in the Gulf countries (which may resort to desalination) or in countries with more surface water (like Morocco). More so, because domestic and agricultural water interests compete—Amman's drinking water supply depends on the same groundwater.[2]

Innovations like (Mega-) WaHa present a solution to the water scarcity and overexploitation problems in Jordan. Groundwater extraction, though historically identified and heavily subsidized by the government as the solution to water scarcity, has become one of the drivers of the ever-increasing water problem in an arid country. In the mid-1990s, the government began introducing control measures, implementing permits, meters, water quotas, and tariffs to manage extractions to cope with the consequences of free licenses for well constructions it issued in the 1980s (Molle et al. 2017). But most of these regulation efforts have failed. Unauthorized well constructions and unmonitored extractions are ongoing, especially in areas where the land tenure status of constructors is unclear. Moreover, heavy subsidies are driving overexploitation: both over-extraction and domestic water overconsumption. In 2010, while food subsidies were $105.87 million, as high as 48% of the total household water bill was subsidized (UNEP 2020). Offering both domestic and agricultural water alternatives, WaHa can help ease the water pressure, although water supply through this innovation needs to be able to compete in the market or be subsidized similarly to groundwater.

Tax exemptions as financial incentives are essential to lower the production costs of MegaWaha and to make it cheaper and, thus, easier to scale in Jordan. Prime Minister's tax exemption law for companies contributing to Jordan's sustainable development in multiple sectors, including energy, water, and health, is a potential way to achieve this. Tax exemption is critical for AquaPoro since Jordan is a high-tax country: the standard corporate tax rate for companies stands at 20%, varying from 14 to 35% for various sectors and branches of business (AHK 2024). High taxation leads to high costs and high selling prices. Exemption from import duties and value-added tax could also be beneficial in decreasing the importing costs of materials (e.g., stainless steel) required for manufacturing the advanced water harvesting technology. The Prime Minister's law exempts businesses from all taxes on imported materials and could be a way to benefit from an exemption.

[2] The literature argued that by prioritizing domestic supply, the government has sought to reduce groundwater use by agriculture in the highlands against strong agricultural coalitions warring for groundwater interests and that in massive amounts in small areas driving overexploitation. Reallocation (shifting priority water users through policy measures) to municipalities can help address the urban water issue. But also, as scholars discussed, reallocation of water to urban or industrial uses often threatens the livelihoods of the poorest households, typically farmers, and increases food prices (Meinzen-Dick and Ringler 2008; Molle et al. 2020).

While explicit information on tax exemptions and subsidies for start-ups in sustainable water technologies in Jordan is limited, the government's strategic plans and international collaborations indicate a supportive environment. Start-ups like AquaPoro may benefit from engaging with these initiatives to access potential financial and technical support:

- *Green Growth National Action Plan 2021-2025—Water Sector*: This plan outlines Jordan's commitment to sustainable development in the water sector. It emphasizes integrating green growth principles, which may include support mechanisms for start-ups developing sustainable water technologies. While the plan does not explicitly mention tax exemptions or subsidies, it provides a framework that could facilitate financial and technical assistance for innovative projects (Ministry of Environment 2020).
- *National Water Strategy 2030-2040:* This strategy addresses the financial sustainability of Jordan's water sector, acknowledging existing financial deficits and the reliance on operational and capital subsidies. Although it focuses on broader financial challenges, the strategy's implementation may open avenues for private sector participation and potential incentives for start-ups offering cost-effective and sustainable water solutions (Ministry of Water and Irrigation 2023).
- *International Funding and Support:* Jordan has secured significant international funding aimed at improving water security and promoting sustainable practices. For instance, the European Investment Bank provided a €400 million loan to enhance water availability and sustainability across the country. Such funding initiatives often create opportunities for start-ups to engage in projects aligned with national priorities, potentially benefiting from financial incentives indirectly (European Investment Bank 2024).
- *USAID Water Innovation Technologies (WIT) Program:* The WIT program, implemented between 2017 and 2022, adopted a market-based approach to improve water use efficiency in Jordan. It facilitated partnerships between the private sector and local communities, providing a platform for start-ups to introduce and scale innovative water technologies. While direct financial incentives from the government were not specified, such programs often include components like grants or technical assistance to support participating enterprises (Mercy Corps 2022).

Jordan's energy sector reforms led to a few other regulations seeking to incentivize sustainable enterprises in Jordan, which WaHa devices with a solar energy upgrade could potentially benefit from. After the 2009 oil price shock, the Jordanian government introduced fiscal incentives to promote renewable energy and energy efficiency. These include customs and sales tax exemptions for renewable energy-related imports, grants for energy-efficient vehicles, and eliminated sales taxes on solar water heaters. The Jordan Renewable Energy and Energy Efficiency Fund, established under Law No. 13, supports a Green Economy by offering subsidies and interest rate reductions for renewable energy projects, including a Public Equity Fund to enhance private investment and credit access. In 2012, tariff ceilings were set for electricity from renewable sources. Additional mechanisms like the Environmental Protection Fund and the Green Investment Fund focus on addressing environmental issues. These initiatives aim to facilitate Jordan's transition to renewable energy and sustainability (UNEP 2020).

AquaPoro highlighted a lack of clear regulatory information provision. Financial incentives for such sustainable start-ups are indeed not easily accessible online via a literature search. The founders reported that to explore the possibility of benefitting from incentives, they hired lawyers to examine regulations. The lawyers, however, could not obtain much information for as long as two months until our interview. They also reported having arranged a meeting with the General Secretary at the Ministry of Investment to achieve clarity and support around tax exemptions. Allegedly, in Jordan, the law does not apply to every business in practice, even though they may be eligible on paper. The lack of clear regulatory information and the perceived discrepancy between law and practice motivate businesspeople to seek support and benefit from special financial incentives through *wasta*, a form of favoritism established through personal connections, as unpacked next.

### Governance: Wasta—Social Capital for Business

Besides the formal policy environment, from starting a business to getting credit and financial incentives, all business stages in Jordan are filtered through favoritism (*wasta)*, which disadvantages enterprises without strong networks. *Wasta* involves utilizing personal connections, relationships, or social networks to gain preferential treatment in professional, governmental, or economic contexts. A study showed that over 75% of surveyed individuals found *wasta* crucial to access public sector jobs or services, highlighting its widespread influence in daily economic and administrative transactions (Loewe et al. 2007). Wasta has both positive and negative aspects (Transparency International 2021). On the positive side, it facilitates informal problem-solving and networking and

can expedite processes in bureaucratic systems, particularly benefiting smaller or family-run businesses in accessing government opportunities. However, it often undermines merit-based hiring and competition, favoring those with connections over qualified individuals, which can stifle innovation and efficiency. Multinational corporations find the reliance on wasta frustrating and unpredictable, as it deviates from transparent and rule-based practices. Companies lacking strong connections are disadvantaged; it creates an uneven playing field. Additionally, it leads to market inefficiency and resource misallocation and fosters perceptions of corruption, eroding trust in public institutions.

AquaPoro perceives *wasta* as culturally significant in Jordan and an integral part of governance as it rules formal processes with ministries. As the founders put it, "If you do not have *wasta*, the system does not go anywhere." But also, it nurtures a delicate balance of hierarchy and cultural norms around doing business that can be counterproductive and create problems when the rules are not followed. The founders argued that, for instance, if businesses seek and receive support from the highest-level officials, red tape is overcome, matters are resolved, and benefits are achieved quickly indeed, but this makes them a target by the lower-level officials down the line. Operational-level bureaucrats running the system sometimes get upset or offended if they are circumvented. Whether and when to use *wasta* must be carefully decided. According to the founders, bringing lawyers to attempt to clarify regulations and fast-track access to tax incentives can backfire with avoidance ("everyone stiffens up and tries to act differently and like they do not know anything") and raises eyebrows in government offices. The founders do not view *wasta* as corruption because they do not bribe anyone; officials in high places only champion applications they personally think are beneficial to society. However, its implications for business appear complex and substantial as it creates room for such support to be based on personal gains that are nonmonetary or career advances instead of merit based.

AquaPoro benefitted from *wasta* to some extent, but much uncertainty remains around what other connections would help it resolve a spectrum of business climate challenges. Its connections with the Royal Scientific Society, the country's leading national research institute, and directly His Majesty the King have been useful; the king facilitated an order of 1000 WaHa units through the Royal Court and indicated his endorsement for the MegaWaha project from day one. The founders estimated that to benefit from laws around tax exemptions through *wasta*, it may need to approach the ministers of water, environment, agriculture, and industry and trade, the Prime Minister, and "go through the whole cabinet." While they are uncertain whether they would qualify for a tax exemption, although the business aligns with the formal requirements of the law to become a potential beneficiary, the Ministry of Investment would likely need to be the champion and receive endorsement from the Royal Court, or alternatively through the Sharia government, which is the Royal Court under His Majesty the King.[3] Although *wasta* served useful for AquaPoro, a merit-based endorsement must be consistently available to all sustainable enterprises and drive improvements in the formal institutional environment with clear regulatory information provision.

Efforts to mitigate favoritism need to be on a national level through reforms, education, and cultural shifts to foster a fairer and more transparent business climate in Jordan. Companies cannot be expected to avoid or escape the system individually in which they must operate and survive. It needs to be acknowledged that the government has taken steps to mitigate *wasta* through administrative reforms and anti-corruption initiatives. Automating services and promoting e-government initiatives aim to minimize human discretion in service delivery. Organizations like the Jordan Integrity and Anti-Corruption Commission are tasked with addressing favoritism and promoting transparency in public and private sectors (JIACC 2023). To increase awareness about the negative aspects of *wasta*, educational institutions and NGOs in Jordan are working to promote merit-based principles among younger generations. Moreover, partnerships with organizations like the OECD have provided frameworks for regulatory reforms and better governance to reduce favoritism and corruption (OECD 2022).

[3] Governance in Jordan is based on the concept of separation of powers between Sharia and the statutory law, according to which the supreme system does not interfere with the parliament. Still, it can have considerable influence in easing the operations of businesses that they support. Having support from the royal court is considered useful.

### Trading Across Borders: Import and Export

One enabling environment issue involves importing parts for building water harvesters due to customs challenges. The start-up relies on an overseas contract manufacturer for components, with crucial humidity-absorbing material sourced from China. They currently hold half a ton of this material, while Mega-WaHa requires only 150 kilograms for prototypes. Stainless steel is sourced locally near Amman, and the start-up imports two WaHa device versions: a fully built-up device for countries without trade agreements and a semi-knockdown kit that is assembled in Jordan for export to countries with free trade agreements like the US, Canada, and Singapore with a made-in-Jordan label.[4] Importing knockdowns offers businesses cost savings and regulatory benefits, such as avoiding import taxes. However, Mega-WaHa is still in the prototype phase, and the feasibility of mass manufacturing in Jordan remains uncertain, leading founders to consider options for scaling production.

AquaPoro indicated facing challenges in understanding the regulatory environment for their products. They note that many countries follow strict EU regulations and aim to obtain CE marking, which indicates compliance with high safety, health, and environmental standards in the European Economic Area (EEA) (EC 2024b). Manufacturers must conduct conformity assessments and maintain technical documentation, while intermediaries must ensure legal compliance for the products they handle. Once these requirements are met, products with CE marking can be traded in the EEA without restrictions. The startup has researched regulations regarding hazardous substances and waste management for WaHa but still needs to do so for Mega-WaHa, while public information is available online.

Complying with various regulations required by different regions will inevitably affect the costs of entering new markets. For instance, WaHa has identified Australia as its second market; however, the start-up is still unaware of the specific costs and regulations associated with entering this market despite regulatory information being publicly available online. While there is a general need for testing, they lack detailed knowledge about the associated expenses. A regulatory consultant provides the founders with all the necessary product regulations to follow.

### Market Demand and Expansion

The concept for Mega-WaHa emerged from an existing demand for a larger version of WaHa, further encouraged by the King. To capitalize on this demand, AquaPoro recognizes the need for a comprehensive marketing and market expansion strategy as part of its business plan, particularly since Mega-WaHa remains in the product development and testing phase. The start-up's immediate priorities are to complete this stage, conduct pilot testing on farms, and fulfill existing WaHa orders before advancing to manufacturing and marketing Mega-WaHa.

Despite general demand for Mega-WaHa to address agricultural water scarcity in Jordan, the start-up lacks clarity on its specific applications, posing a marketing challenge. The founders note that while the team has strong expertise in water technology and energy, they lack insight into agricultural needs—despite the device being designed for this sector. Unlike WaHa, which primarily serves urban drinking water needs (e.g., homes, offices, clinics, and schools), Mega-WaHa offers a significant capacity upgrade at 500 liters. However, this volume is insufficient for irrigation, as farming requires much higher daily water consumption. Without clear data on demand, the founders remain uncertain about target markets, making it difficult to develop a strong marketing strategy.

Another key factor influencing demand and marketing is the cost of water per cubic meter. The start-up has identified a significant information gap, as water prices reportedly vary widely across the country. Gaining a better understanding of both water costs and potential agricultural applications for Mega-WaHa will help benchmark it against municipal water pricing and support market entry.

4 A knockdown is a collection of parts required to assemble a product. The parts are typically manufactured in one country or region and then exported to another country or region for final assembly. The import of a fully assembled product is referred to as Completely Built-Up. A semi-knockdown is an incomplete or partially assembled product. Both complete and incomplete types of knockdowns are referred to as knockdown export.

The start-up currently lacks the labor force to provide operation and maintenance (O&M) services in remote farming areas, which may become a marketing challenge. The AquaPoro team consists of eight employees and cannot offer the labor force to travel to remote areas away from its Amman HQ. However, the prototype proof of concept device requires regular monitoring to ensure that the system is running. A possibility is to adapt regular WaHa's O&M model to MegaWaha, where sales and aftersales services encompassing maintenance work are managed by AquaPoro's distribution partners. The operation does not require a specialized workforce since the device will most likely be connected to the grid or a renewable energy source, such as solar, and once the device is plugged into a power network, users only need to use the switch to run the system. Maintenance for WaHa has been simple; only the air filters blocking out dust and microorganisms must change semi-annually, which the start-up can centrally cater to. Still, MegaWaha has bigger storage and water harvesting capacity and will potentially include secondary infrastructural systems channeling water from the depository, which may require a standby local team.

Mega-WaHa would be most effective if externally funded by development and humanitarian aid agencies, ensuring affordability and accessibility for target communities. The system should be operated and maintained under community-based management by its beneficiaries, with additional support from distributor agents and AquaPoro HQ staff for aftersales services and technical assistance. To ensure long-term operational sustainability, an additional service fee should be included in the financing agreement with aid agencies. However, transitioning ownership to the community remains the preferred approach for sustainable management.

If targeting low-income communities in fragile and conflict-affected areas, direct sales are not a viable model. Instead, Mega-WaHa should be positioned as a high-impact aid product. Market expansion efforts should prioritize partnerships with aid agencies. Establishing collaboration as soon as positive prototype results are available will be critical for scaling the solution.

A thorough market analysis is recommended to identify key demand areas and assess regulatory requirements. Potential market intermediaries, such as importers and distributors, should be identified and engaged early in the process, as their regulatory requirements could impact material selection and manufacturing costs. In some cases, higher costs may be justified if the profit potential outweighs the investment.

Insights from the IWMI stakeholder workshop in Amman highlighted multiple high value uses for MegaWaHa's purified water beyond irrigation. First, it can be mixed with existing water sources to dilute salinity and enhance agricultural viability. Second, it provides high-quality water for fertilizer preparation, allowing better control over crop application. Third, it can help expand irrigated land areas. Additionally, domestic and farm-related applications include spraying water to remove dust from trees, washing fruits and vegetables, and other household uses. These applications should be further explored and incorporated into the business plan and marketing strategy.

IWMI is collaborating with AquaPoro to install a prototype near Amman, ensuring accessible O&M support during the initial testing phase. The start-up is also working with IWMI to identify farms where Mega-WaHa can address alternative water needs, refining its marketing approach.
Given AquaPoro's limited reach in remote areas, training local residents—particularly in rural and refugee communities—to manage daily O&M will be crucial. These trained individuals should be responsible for reporting repair and maintenance needs to AquaPoro HQ. Engaging community-based organizations (CBOs) can help build trust with farmers and support long-term project sustainability. A structured community-based working group could manage the devices, with financial backing from an NGO. This model could enable the community to generate small profits, which could be reinvested into local food and nutrition initiatives, such as irrigating a community garden.

### 3.2. iPlant Jordan—A Vertical Farming Revolution

iPlant is a Jordanian agritech startup founded in 2022 and dedicated to revitalizing underutilized urban landscapes by implementing advanced vertical farming solutions. Its mission focuses on promoting sustainability and enhancing food security within urban environments. The founders envision leading the transformation of urban areas in the Middle East and North Africa (MENA) region into thriving agricultural ecosystems. By leveraging cutting-edge technology and innovative practices, they aim to convert neglected urban spaces into productive

landscapes and buildings. Their approach merges modern agritech with sustainability principles, contributing to the development of greener cities across the MENA region. Experts in advanced farming practices, they offer comprehensive consultation services and tailor-made solutions designed to bolster food security, enrich urban biodiversity, and enhance profitability for growers. Based on its website, iPlant's diverse range of services includes (1) indoor vertical farming solutions to enable growers to maximize output while minimizing space and resource use, (2) rooftop farming to transform unutilized rooftops into vibrant green spaces, enhancing urban aesthetics and functionality, (3) customizable green roof systems, adding visual appeal, promoting biodiversity, and improving energy efficiency for buildings, and (4) intelligent farming automation as cutting-edge farm management system streamlining operations year-round, overseeing everything from crop monitoring to nutrient management (iPlant 2024). Through these initiatives, the start-up aims to redefine urban agriculture and foster a sustainable future for cities in the region.

The start-up seeks to foster food security by prioritizing building its projects in water-scarce areas where the fresh produce serves the community's food needs. The operations have been supported by the United Nations Development Program (UNDP) and the Royal Scientific Society in Jordan, one of the biggest research centers in Jordan, which identified several sites for iPlant to showcase its technology as one of the eight start-ups they supported due to their contribution to achieving water efficiency in food production. Each installation is embedded in and benefits the communities that they serve (e.g., a school for disabled individuals). Currently, the startup operates single vertical farming units in four different locations, including Jerash and Irbid. They are also launching a new project in Deir Alla, with a research center with an indoor vertical farming room. The startup primarily focuses on growing pesticide-free fresh greens, such as basil, lettuce, and various herbs. While it previously experimented with growing fruits like cucumbers and cherry tomatoes, those efforts were only for trial. The produce stays with these communities and is not sold; instead, it is distributed among the staff and community members or used in the kitchen. For instance, the school cultivates herbs like mint for tea for the teachers and students. The research center makes food in its kitchen and distributes lettuce and other produce to center staff to take home. The team has adapted its approach based on the specific needs of the people managing the farming units and tried to focus on different environments and community groups with different levels of agricultural background and expertise.

The O&M of farming devices are not labor intensive and are typically managed by local operators within the communities they serve. For example, the research center assigned an engineer to oversee the unit after the installation because the system was semi-automated, requiring some human intervention. The engineer kept the founders informed with weekly updates, and in return, the founders supplied the center with resources. They provided seedlings for three harvests, after which the center began cultivating its own seedlings, necessitating the start-up to supply only nutrient solutions. Within the school, initially, a few operators were hired, and the start-up trained them on how the system operates. Over time, even kitchen staff got involved in running the system. They only contacted the start-up a couple of times for nutrients and supplies, and when a pump broke, they requested a replacement. Most O&M needs that the community cannot resolve are managed by the team based in Amman. However, because the team is yet small (three co-founders, an agricultural engineer, a consultant, and an agronomist) and commuting from Amman to remote project sites can be challenging and the team being away from the office for several days disrupts the workflow, the start-up occasionally hires temporary and part-time workers for short periods to provide specific expertise required for projects, such as automation and control, as well as agriculture. Eight individuals are hired every couple of months on an as-needed basis.

The invention of the sustainable version of the vertical farming unit called Green Spin, supported by the Peace-and-Stability Accelerator, was motivated by a business urgency that LED imports for the conventional unit was substantially delayed and incurred high costs. The founders explained that the delays in shipping LEDs, essential light-emitting devices for farming units, have been one of the biggest threats to business operations and growth. Because LEDs are expensive, they cannot afford to stock them and must purchase them only as projects require. They attempted to secure funding to establish an LED production line in Jordan but were unsuccessful, while there is currently no production facility in the MENA region. These delays have resulted in significant financial losses; the founders reported losing as much as 40% of their start-up capital while searching for the right LEDs and a reliable supply source. This process has also been time-consuming. The delays stem from various suppliers—who they explored—and customs issues, which have further increased the costs of the lights. Importing seeds and other important parts, such as sensors and agricultural materials, also incurred substantial costs in the past. Ongoing

projects have faced substantial delays as they await the arrival of the LEDs. The quality of the LEDs is a critical factor, as they significantly influence plant growth rates and can even cause diseases. Additionally, selecting the appropriate LEDs is vital for safety, as unsuitable lights present a fire hazard due to the high humidity commonly found in vertical farms, which is often overlooked.

Special regulations are required in Jordan to recognize and incentivize such innovative agritech start-ups offering water and food solutions: in the country, there are tax and duty exemptions for agricultural supplies, but LEDs are not considered as such. iPlant imports agricultural censors to build controllers but pays three times more than conventional agricultural enterprises. Reportedly, whether the start-up counts as an agricultural enterprise or not depends on the customs officials and their personal opinions instead of official guidelines, and the registered start-up information is insufficient to overcome this. Because iPlant is not recognized as such, it also has to pay for higher electricity costs than agricultural enterprises. Moreover, the leafy green produce is not considered organic, despite being pesticide- and GMO-free, since it needs to be produced in the soil to be considered organic, which is not the case for hydroponics-based vertical farming systems. Vertical farming is a new concept, and the regulatory environment in Jordan is not sufficiently responsive to its national agritech innovations that are rapidly evolving, which puts off the development and scaling of innovations that are able to address critical food and water challenges.

Green Spin integrates solar energy into the regular vertical farming system instead of relying on LEDs, which are expensive and have high energy costs—a low-cost and renewable alternative targeting zero electric power and zero water consumption. The system has an integrated module that rotates and exposes all levels of plants to sunlight. The start-up looks at the design details and the parts needed to build the prototype, which requires parts different from the regular unit, such as a transparent material on the container stock to allow sunlight for the plants. All parts needed for this technology are available in Jordan and can be supplied by metal manufacturers and shops. Electricity can be integrated into the system to complement solar energy to add supplementary lighting and allow a longer system operation throughout the day instead of a 16-hour cycle. However, Green Spin is currently at a risky stage since the whole technology needs to be developed from scratch. The system is envisioned to have a circular movement where plants rotate to sunlight to get the necessary nutrients. Motors and belts are parts of the design that allow this circular movement. This new design is expected to cut the overall cost of vertical farming through the regular LED-based units by half:  One solar-fed container will produce as many plants as five regular units do, while the unit price and the production and O&M costs will be lower due to less dependence on costly electricity and no use of expensive LEDs.

For Green Spin, the start-up aims to standardize an O&M model of providing the first two harvests upon installation and then slowly transferring the O&M fully to two persons (clients/beneficiaries) from host communities appointed to care for each unit. These persons will receive training while the start-up aims to automate the process as much as possible with minimal labor requirements. In the Green Spin manual, clients are envisioned to only sow and harvest the plants out of the container without needing sophisticated agricultural knowledge but following basic instructions. If the community or client requests the start-up to take care of the entire operations, it will be possible to pay a service charge for the start-up to hire employers to run the system and deliver harvested plants.

Although LED costs and delays encouraged the business to create and scale a more sustainable innovation, the regular vertical farming unit already offers a water efficiency and food solution for communities in need. Jordan may benefit from examining customs issues and the associated costs of importing such essential parts to ease the overall business environment for such impactful start-ups to survive and address food and water challenges.

While most installation sites to date have been identified and supported by development partners for community use in water-scarce areas, there are opportunities for commercial sales and distribution. The founders argued that most selling will likely happen through connections rather than online sales. Only one unit was sold to a restaurant that wanted to grow and use basil. A potential commercial buyer on the higher-end market was interested in setting up a system for 3000 lettuces a month, but the start-up did not have the opportunity to build the unit without a cash advance. For on-the-ground operational WFP and IWMI staff, it is worthwhile to identify potential development partners and national entities, as well as marketing opportunities to commercial establishments, such as large restaurants, museums, and convention centers, with sufficient purchasing power to explore setting up indoor units as sustainable local and visually appealing alternatives. A similar start-up called InFarm (followed by many others), founded in Berlin in 2013, trailblazed a zero-waste indoor farming revolution in Europe in numerous locations before the COVID-19 pandemic and has recently identified the Middle East, starting with

Qatar, as a lucrative new market for expansion (Infarm 2023; Sifted 2025). According to TechCrunch (2021), the enterprise has already raised $200 million for this international expansion. IPlant, already based in the Middle East, has an opportunity to expand and install vertical farming units in lucrative regional markets. It is recommended that the team conduct a market analysis and explore the expansion options.

Even the conventional LED-based system offers sustainability value through zero-waste, local (with low-carbon footprint), and supply of perishable pesticide-free nutritious produce bought and consumed in mass. There is a need to elevate iPlant's value promise in marketing when similar enterprises capitalize on sustainability facts such as that vertical production installed in areas of consumption can use 95% less water, 75% less fertilizer, no chemical pesticides, and 99% less land, substantially decrease carbon emissions through 90% less transport and preserve nutrition value of leafy greens which lose their key nutrients in less than seven days of harvest (Astanor 2025). Integrating the full impact potential into the marketing narrative will likely attract more grants and loans from national and international financial institutes (e.g., zero-interest loans for agriculture through the Ministry of Agriculture) and private investment, catalyzing such expansion to both communities in need and lucrative commercial urban markets. Still, support is needed for the development of Green Spin: the integration of an affordable solar energy technology replacing the costly LEDs will lower the unit price and at the same time increase the innovation's sustainability impact.

### 3.3. Koolboks Nigeria—Renewable Solutions for Cooling

Koolboks is a Nigerian enterprise that sells solar-powered coolers for domestic and commercial use. This innovation seeks to address uneven and erratic electricity supply in Nigeria, also recognized by the World Bank (2020) as creating a disabling environment for business, turning a crisis into an opportunity. A prize winner, it has been acknowledged as a cleantech innovation revolutionizing the energy sector and has won several grants. By offering "sustainable and affordable refrigeration" powered renewably, this start-up contributes to food security by preventing food loss: only about 17% of the population has access to cold storage for food preservation in the African continent (Koolboks 2024). The business started in 2018 and kicked off in 2020 after COVID-19, when the start-up started campaigning for sales as a solution to help people lower the frequency of their commute to crowded marketplaces transmitting the virus. In addition to helping combat food loss, the coolers preserve the nutritional quality of food. Cooler options are available in different sizes to accommodate varying domestic and commercial needs in Nigeria and, on a smaller scale, Kenya and Uganda.

Part of Koolboks' social impact narrative is offering loans for small entrepreneurs, especially women, who use these refrigerators to sell food as a primary income source, thus promoting financial inclusion. Many customers are commercial, small-scale retailers of perishable goods like meat that have increased income security through this technology. The coolers keep food fresh for up to four days and help save on electricity and transportation costs for commercial users. Women constitute most of the customer base. The financing opportunities are tailored to the customer's needs: the loan repayment period varies from three to 24 months, with a maximum of two years.


*A Koolboks customer dealing in meat.* Source: Koolboks (2024).

The start-up considers the loan default rate relatively small thanks to a smart device integrated into the freezer system. This device unlocks the coolers upon the down payment and keeps the system active if loan installments are received. If the customer misses a payment, the system shuts down and becomes inoperable, potentially putting the customer's business at risk, thereby motivating them to repay loan installments on time. The device entirely deactivates once the repayment is complete, and the freezer is unlocked indefinitely. This integrated intelligent system helped to keep loan default rates low and manageable. But also, the enterprise has a unit responsible for finance application and debt collection. The grants received through the WFP's Innovation Hub will allow the enterprise to expand its business in Uganda and offer financing services there and in additional countries.

### Trading across borders

Nigeria ranks poorly in trading across borders, mostly stemming from import complications, ranking 179 out of 190 countries in World Bank's doing business index, which also adversely affects start-ups like Koolboks. In trading across borders, relevant government agencies include customs, port authorities, road police, border guards, standardization agencies, ministries or departments of agriculture or industry, and national security agencies (World Bank 2020). Significant problems and delays are reported in document compliance, border compliance, and domestic transport impacting trade.[5]

One of the most significant enabling environment challenges that Koolboks encounters is related to customs. The enterprise imports knockdown kits from China, which are assembled into the final product in Nigeria. Assembling locally helps keep an overview of supply compared to demand, among other advantages, but the enterprise frequently encounters uncertainties around documentation at customs and duty during the release of kits into the

[5] Based on World Bank (2020), document compliance processes consist of (1) obtaining, preparing and submitting documents during transport, clearance, inspections and port or border handling in origin economy; (2) obtaining, preparing and submitting documents required by destination economy and any transit economies; and (3) covers all documents required by law and in practice, including electronic submissions of information. Border compliance includes (1) customs clearance and inspections; (2) inspections by other agencies (if applied to more than 20 percent of shipments); (3) handling and inspections that take place at the port or border. Domestic transport refers to (1) loading or unloading of the shipment at the warehouse or port/border; (2) transport between warehouse and port/border; and (3) traffic delays and road police checks while shipment is en route.

country. The start-up is registered and has all the required documents for the kit parts, including solar panels and batteries, but signing the parts into the country is up to the individual official who receives them at that time. The officers often request additional documents not officially needed, which are sometimes foot-dragging motivated to collect informal payments. Due to this, the last shipment and border clearance took more than 60 days, with additional documentation and payment asked to clear the goods, which incurred substantial time and money loss detrimental to the business. Clearing and beginning domestic transportation of the goods took about 14 days in Nigeria only.

### Getting Credit, Paying Taxes, and Financial Incentives for Sustainable Enterprises

Nigeria has an ambitious energy transition plan and supports sustainable projects. Although the Koolboks innovations use solar energy and have won prestigious awards and grants (e.g., from the Ikea Foundation and the International Finance Corporation) recognizing its role in energy transition, the start-up indicated that it lacks information about and does not sufficiently benefit from financial incentives Nigeria offers for sustainable enterprises. The start-up reported that it received support as part of a results-based financing scheme offered by the Rural Electrification Agency under the Nigeria Electrification project, which is looking to make energy transition projects, especially in most rural areas. Beyond that, the start-up stated that manufacturing energy innovations is expensive, and financial incentives and custom clearance support could help keep costs low. The costs and inevitably cooler prices need to be kept especially low in conflict-affected areas where purchasing capacity is especially low. Guidance around financial incentives is requested.

Nigeria offers several financial incentives to support sustainable enterprises, particularly those involved in renewable energy solutions like solar cooling technologies that Koolboks is recommended to look into. These incentives aim to promote investment in clean energy and enhance the financial viability of such ventures. Key incentives include:

(1) *Pioneer Status Incentive (PSI):* Administered by the Nigerian Investment Promotion Commission, the PSI grants qualifying companies a tax holiday, exempting them from corporate income tax for a specified period. Renewable energy projects, including those focusing on solar technologies, may be eligible for this incentive, thereby reducing their tax burden and improving financial sustainability (Sunmola 2022).
(2) *Value-Added Tax (VAT) Exemptions:* The Nigerian Finance Acts (2019 to 2023) have introduced VAT exemptions for specific goods and services, potentially including renewable energy equipment and products. This measure aims to lower the cost of deploying sustainable technologies, making solutions like solar coolers more affordable for businesses and consumers (Bloomberg Tax 2023).
(3) *Universal Energy Facility Grants:* Managed by Sustainable Energy for All, these grants provide results-based financing to renewable energy companies. In Nigeria, the UEF has supported stand-alone solar projects that enhance energy access for small and medium-sized enterprises (SMEs). Enterprises developing solar cooling solutions can apply for these grants to fund their projects and expand their operations (SEforALL 2023).
(4) *Central Bank of Nigeria (CBN) Solar Intervention Fund:* The CBN offers a solar intervention fund aimed at expanding energy access through renewable solutions. This fund provides financial support to businesses investing in solar energy projects, facilitating the adoption of technologies like solar coolers across various sectors (Solar Energies 2024).
(5) *Electricity Act 2023 Incentives:* The Electricity Act 2023 mandates the Ministry of Finance to introduce tax incentives to promote the generation and consumption of electricity from renewable energy sources. This legislative framework is expected to attract more investments into the power sector, benefiting enterprises engaged in renewable energy projects, including those specializing in solar cooling technologies (Andersen 2023).

These incentives reflect Nigeria's commitment to fostering a sustainable energy landscape. Start-ups like Koolboks focusing on solar cooling technologies are encouraged to engage with relevant government agencies to explore and benefit from these opportunities.

### Market Demand and Expansion

One of the enterprise's key priorities is expanding its market presence across Nigeria, Africa, and beyond. However, it faces significant challenges due to limited financing and market information. Through the WFP-CGIAR

pilot program, the start-up has begun exploring expansion into northeast Nigeria, particularly Adamawa State. Until now, its operations have been concentrated in the south and southeast. Despite this progress, the enterprise still lacks comprehensive market intelligence and requires a structured approach to market identification, risk assessment, and cost-benefit analysis—especially for high-risk, conflict-affected areas like Adamawa.

Situated on the southern fringes of the Sahara Desert, Adamawa faces severe desertification and land degradation and has been classified as one of the world's most "ecologically unstable" regions (Nicholson et al. 1998). Additionally, the Boko Haram insurgency has devastated the area's socioeconomic landscape, causing mass displacement, loss of lives, destruction of infrastructure, and restricted access to markets and financial services. In 2024 alone, over one million people—24 percent of the 4.4 million displaced individuals in the BAY (Borno, Adamawa, and Yobe) states—are targeted for humanitarian assistance (UN 2024). Social cohesion remains fractured, state support is limited, and threats from non-state armed groups—including kidnappings and violence—are persistent challenges (Osei-Amponsah 2024).

Currently, the start-up has no visibility into key market factors such as demographic data, customer profiles, and competitive landscapes in these regions—critical information for informed business decision-making. The only insights available come from the FCM initiative, which provides geopolitical and security assessments, including "red zones" or high-risk areas. Entering these markets entails significant risk and requires robust support networks, as well as reliable local partners and distributors.

To facilitate market entry, the International Institute of Tropical Agriculture, on behalf of the FCM initiative, is assisting with business planning and establishing connections with regional partners who understand both solar energy systems and the local landscape. However, for sustainable expansion beyond the pilot areas, the enterprise needs access to broader market intelligence. This includes deeper insights into regional demographics, economic conditions, and consumer needs, allowing it to make independent, well-informed expansion decisions. Furthermore, product development must be tailored to the specific challenges and demands of these regions—an effort that can only succeed once the enterprise gains greater market visibility and understanding.

# 4. Conclusion and Recommendation

This paper has examined the enabling environment challenges faced by three sustainable enterprises: AquaPoro with its MegaWaha innovation, iPlant with vertical farming systems, and Koolboks with solar-powered coolers. Each case highlights unique obstacles that hinder innovation scaling, yet also offers critical insights into the broader systemic barriers faced by sustainable enterprises in Jordan and Nigeria.

AquaPoro's experience underscores the structural challenges within Jordan's business environment, particularly in the water sector. The company's struggles with limited financial incentives, unclear regulatory frameworks, and reliance on informal networks, such as wasta, illustrate the need for substantial regulatory reforms. For AquaPoro to scale effectively, the Jordanian government must prioritize enhancing the transparency and accessibility of regulatory information, especially concerning tax exemptions and import-export regulations for sustainable technologies. Furthermore, expanding financial incentives for water technology companies, including tax exemptions for start-ups integrating renewable energy solutions, could foster broader adoption and reduce costs. To overcome operational hurdles, AquaPoro should invest in market research and establish strategic partnerships with local agricultural experts and distribution partners, ensuring the MegaWaha device is better suited to regional needs and supported by a robust service model in remote areas. Reducing reliance on wasta through stronger rule-of-law initiatives and digitalization of government processes will also be key to creating a more merit-based and transparent business environment.

iPlant's journey illustrates the potential of agritech to address critical challenges in food security and water efficiency in Jordan, yet highlights the constraints posed by outdated regulatory frameworks, high import costs, and limited recognition of agritech within agricultural policies. To scale, iPlant requires targeted policy reforms, including tax benefits for agritech start-ups, streamlined customs procedures, and better access to financing. The company's pivot to integrating solar energy in its Green Spin innovation represents a promising solution to reduce

energy costs and enhance sustainability. For iPlant to realize its full potential, it will need a supportive policy environment and strategic partnerships to facilitate market expansion. With the right investments and policy support, iPlant can play a pivotal role in enhancing food security and environmental sustainability in urban Jordan, contributing to the country's resilience in the face of climate change.

Koolboks faces similar enabling environment challenges in Nigeria, notably regarding customs processes, financing, and market access. To scale its solar-powered refrigeration solutions, Koolboks needs a more streamlined and transparent import process, with clearer documentation requirements and reduced bureaucratic delays. Furthermore, increasing awareness of financial incentives available for clean energy enterprises will help Koolboks lower operational costs and enhance competitiveness. In expanding to conflict-affected areas like Adamawa, Koolboks must prioritize market research and local partnerships to navigate security and logistical challenges. By working with local distributors, community organizations, and government entities, Koolboks can develop market entry strategies that are both contextually relevant and resilient to local complexities.

In conclusion, addressing the systemic challenges that hinder the scaling of sustainable innovations in Jordan and Nigeria is essential to unlocking their full potential. For all three enterprises, advocating for policies that support sustainable technologies and inclusive finance is crucial to creating a more conducive environment for growth. Engaging with policymakers to shape supportive regulatory frameworks can foster innovation, improve market access, and enhance financial inclusion, ultimately enabling these start-ups to contribute to a more sustainable and resilient water, energy, and food landscape in their respective regions. With targeted policy support, financial incentives, and strategic partnerships, these early-stage enterprises can overcome obstacles and significantly contribute to regional development goals in food security, economic inclusion, and sustainable development. By creating more enabling business environments, these start-ups can catalyze the transition to a greener, more resilient future.

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