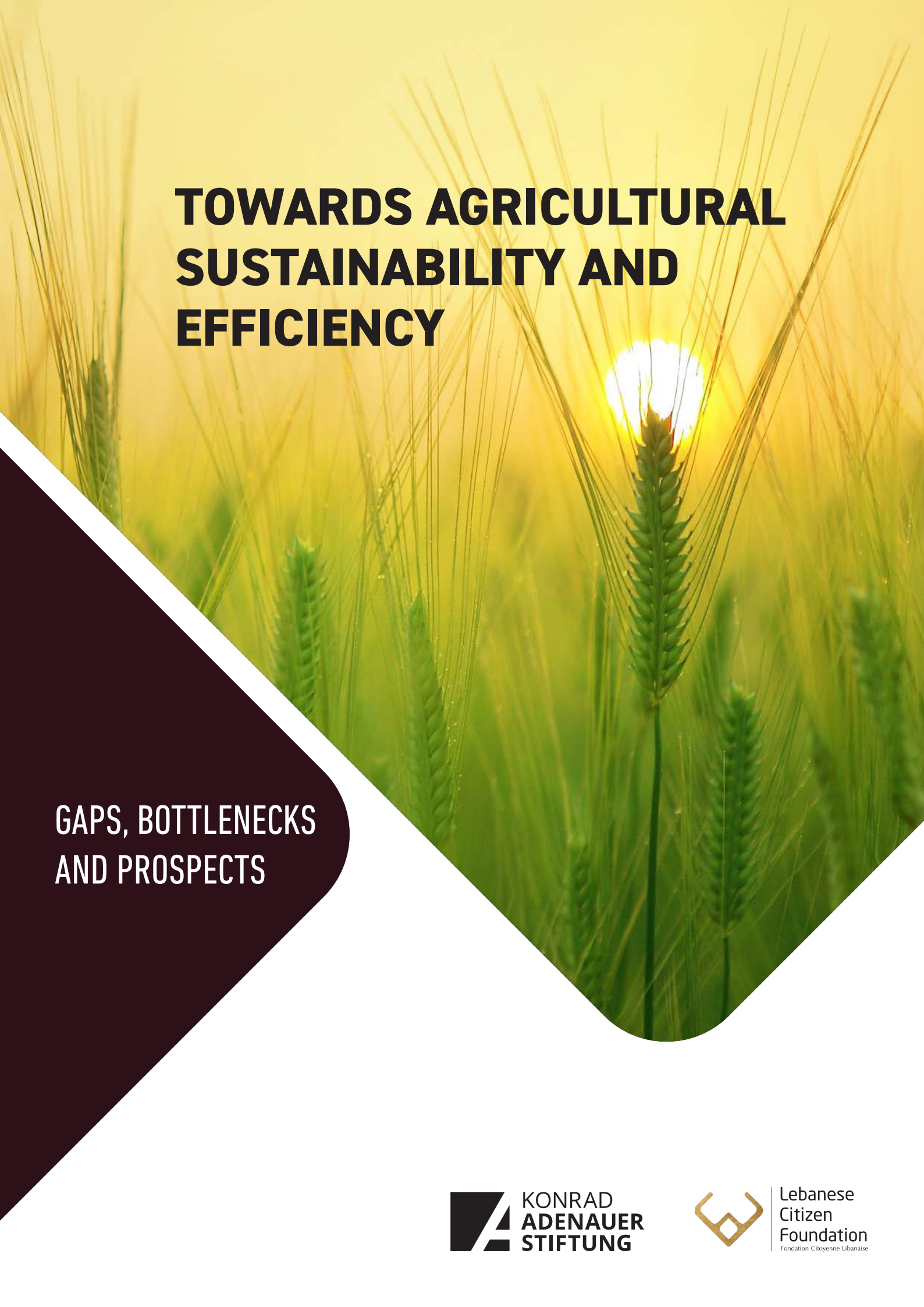
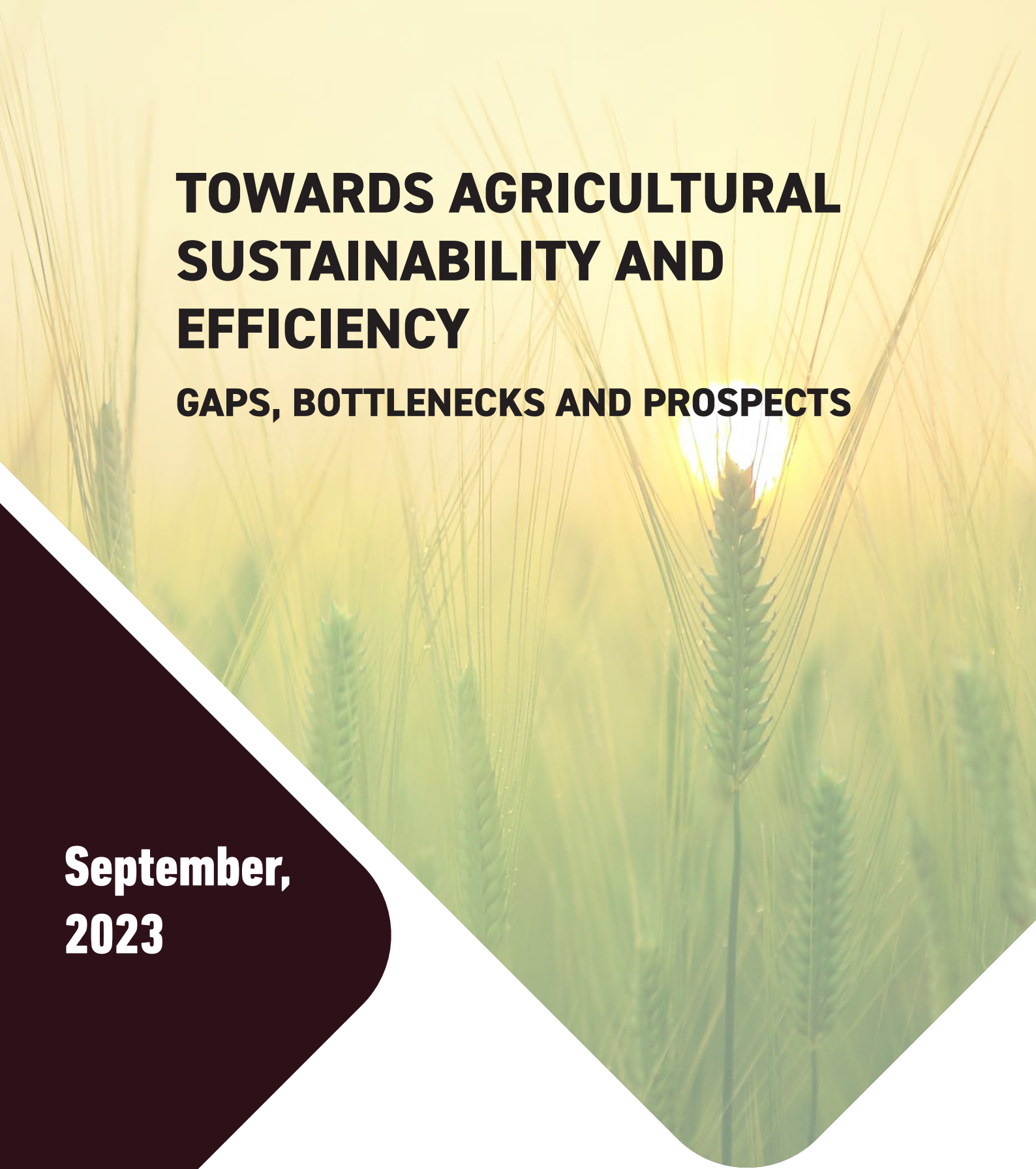


TOWARDS AGRICULTURAL SUSTAINABILITY AND EFFICIENCY

GAPS, BOTTLENECKS AND PROSPECTS

KONRAD ADENAUER STIFTUNG

Lebanese Citizen Foundation
Fondation Citoyenne Libanaise



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September, 2023

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Lebanese Citizen Foundation

The Lebanese Citizen Foundation (LCF) stands as a pivotal non-profit organization committed to fostering a transformative change in Lebanon. Amid the lack of a comprehensive development model and an existing existential crisis, LCF's mandate revolves around promoting efficient and relevant public policy options that address the fundamental needs of the nation's economy, labor market, public and private investment, infrastructure, and social safety nets. With the economy in a free-fall and citizens in despair, LCF takes on the duty to provide hope through clear policy directions and rigorous mobilization towards their implementation.

Rebuilding a legitimate state and displacing the power system in place with its politico-financial oligarchy is a prime objective of LCF. Harnessing non-partisan thinking and public action, the Foundation serves as an instrument of strategic thinking, influencing diverse actors on the Lebanese stage - both local and international. Guided by the values of integrity, empowerment, and inclusivity, LCF is devoted to steering Lebanon past the current crisis and preempting the challenges and essential choices of the future. As an agent of hope, resilience, and sustainable growth, LCF emerges as a significant force advocating for socio-economic and political transformation in Lebanon.

Konrad-Adenauer-Stiftung

The Konrad-Adenauer-Stiftung (KAS) stands as an eminent political foundation, intrinsically linked to the Christian Democratic Union of Germany (CDU). Anchored in freedom, justice, and solidarity principles, KAS is committed to empowering individual futures communities worldwide to shape their future. The foundation's impactful presence, marked by over 100 offices globally and engagement in projects across 120 countries, illustrates its influential role in fostering democracy, dialogue, civil society, and the principles of the social market economy.

KAS stands as a pillar of peace and freedom, promoting continuous dialogue across cultural and national boundaries, fostering mutual understanding and shared values. Its efforts focus on establishing spaces for diverse perspectives, encouraging discovery of common ground, and collaborative solutions. As a beacon of democratic values, peace, and global unity, KAS continues to play a pivotal role in advocating for a world that upholds justice, freedom, and solidarity. Through its unceasing commitment and dynamic international network, KAS indeed illuminates the path towards a harmonious and prosperous global community.

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Foreword

As the founder and president of the Lebanese Citizen Foundation (LCF), I am honored to introduce this pivotal study that explores the profound complexities of Lebanon's agriculture sector. Our deep commitment to social welfare and catalyzing positive change is reflected in our focus on evidence-driven policy dialogues. This study illuminates pressing challenges and latent opportunities in the agriculture sector, offering crucial insights towards holistic reforms for sustainable growth and socio-economic recovery.

Our partnership with the Konrad-Adenauer-Stiftung (KAS) underscores the power of collaboration in undertaking such a substantial task. The study, meticulously prepared, emphasizes the importance of quality over quantity, a principle that guides our proposed reform across all economic sectors in Lebanon. We believe that an inclusive and comprehensive assessment, leading to informed policy choices, is the linchpin of transformation.

At LCF, we deeply value collaboration, dialogue, and rigorous research as tools for positive societal transformation. This study resonates with these principles, presenting a multi-faceted examination and pragmatic solutions to drive policy decision-making and encourage constructive dialogue among stakeholders.

This study's main findings form a three-part roadmap, which LCF will provide as a tool for participatory policy discussions and reform. By proactively addressing systemic vulnerabilities and presenting pragmatic remedies, we aim to guide governmental entities, civil society, and the farming community towards tangible improvement. This study aligns seamlessly with LCF's commitment to fostering engagement, inclusivity, and empowerment in Lebanon.

In conclusion, we believe that the collective implementation of this study's recommendations will significantly contribute to the prosperity of Lebanon's agricultural sector. As we progress, your invaluable support and active participation will be instrumental in steering Lebanon towards a brighter, more prosperous future. On behalf of LCF, I extend our deepest gratitude to all those joining us in this significant endeavor.

Alain Bifani,
Founder and President
Lebanese Citizen Foundation

Acknowledgments

The Lebanese Citizen Foundation (LCF) acknowledges with deep appreciation the collaborative efforts and substantive contributions that have been pivotal to the completion of this study. Firstly, we wish to express our sincerest gratitude to the Konrad-Adenauer-Stiftung (KAS). Notably, we extend thanks to its Resident Representative to Lebanon, Mr. Michael Bauer, and Program Manager, Mr. Hamad Elias. KAS financial support and shared commitment to progressive dialogue and societal development have enabled this study's successful realization.

Our research team, guided proficiently by the senior policy expert and author of the study, Eng. Rodolph Saadé, deserves special recognition. Their interdisciplinary expertise and unwavering dedication have significantly enriched this study. We wish to acknowledge the commendable efforts of Tala Atchan, Yara Ayyoub, and Rony Lahoud, who formed the backbone of this research.

LCF is deeply thankful to the distinguished professionals from the agricultural sector who shared their expert insights and constructive feedback, essentially refining the contours of this study. We extend our gratitude to:

- Mrs. Rana Abdou, an accomplished agricultural engineer and Program Manager at Arc-en-Ciel;
- Mr. Roy Ayek, esteemed agricultural engineer at Debbane Agri;
- Mr. Raffi Debbane, Chairman of Debbane Group;
- Mrs. Soha Frem, Entrepreneur and CEO of Wata Cider
- Dr. Henri Helou, a specialist in Lebanese flora and fauna;
- Mr. Naim Khalil, Director of the Union of Importers and Exporters of Fruits and Vegetables in Lebanon.

We would like to express our gratitude to the representatives from the Ministry of Agriculture, who wished to remain anonymous, but whose contributions were crucial. Additionally, we extend our thanks to the farmers Toni Elia, Abdel-Hamid Khasroum, Youssef Lahoud, and Vera Sakr for their valuable insights and participation in the interviews.

We would like also to thank Mr. Riad Saadé, the esteemed head of the Centre de Recherche et d'Etudes Agricoles Libanais. His extensive support and peerless contributions have been pivotal to this study. His expertise, dedication, and encouragement enriched our research, and for that, we remain deeply grateful.

The amalgamation of these collective efforts and the enduring support of all involved parties have been instrumental in shaping this work. They have provided us with invaluable insights and practical recommendations for advancing the agricultural sector in Lebanon. Their ongoing collaboration continues to propel our mission of fostering sustainable development within Lebanon.

LCF Team

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Executive Summary

Executive summary

The Lebanese Citizen Foundation presents its study, "Towards Agricultural Sustainability and Efficiency: Gaps, Bottlenecks, and Prospects," providing a critical appraisal of Lebanon's agricultural sector. The report disentangles the complex dynamics within the sector, shedding light on its fundamental role in Lebanon's socio-economic framework. The aim is to establish a foundation for informed policy recommendations and strategic interventions to encourage a more sustainable and efficient agricultural industry.

The evaluation examines Lebanon's agricultural intricacies, scrutinizing key trends and factors that influence the sector. Among these are land utilization, principal stakeholders, agriculture-related legislation, trade patterns, food security, the contribution of industries to agriculture, and the sector's present condition in light of numerous crises. This holistic overview facilitates an understanding of the multifaceted issues the sector contends with, including the decline of traditional farming and the impact of the ongoing financial turmoil and the COVID-19 pandemic.

State and Potential of Lebanon's Agricultural Sector: The agricultural sector in Lebanon, despite a 15% production decline since 2019 impacting approximately 20% of the population, exhibits substantial potential. Significantly, about 60% of the country's land is agriculturally viable, highlighting the prospects for considerable sectoral growth. Nonetheless, this potential remains unrealized due to data deficits, hampering strategic planning and investment. The study urges the necessity for research investments to boost agricultural output and guarantee food security. Concurrently, an appraisal of the sector's ongoing initiatives is required to nurture self-sufficiency and sustainable economic advancement.

Lebanon's Agricultural Landscape & Challenges: Detailed mapping and analysis show that agricultural land is dispersed across all eight governorates, with half of the total land holding cultivation potential. However, issues like electricity shortages, impacting crucial irrigation infrastructure, present formidable obstacles to farming. Both government and non-government stakeholders, including research labs, offer essential support to farmers through modernized agricultural practices and solutions. Yet, the limited presence of agricultural cooperatives and a declining youth participation in farming warrant immediate attention.

Agricultural Policies, Practices, and Challenges in Lebanon: A multitude of ministries oversee Lebanon's agricultural sector, potentially giving rise to complicated administrative procedures. Despite this, the sector retains a largely informal character, with many workers unregistered and lacking social security benefits. Trade practices, such as high import duties on locally harvested fresh produce and politically influenced trade concessions, affect the sector's competitiveness. Moreover, the agricultural workforce, despite being significant, is inconsistently recorded, with the majority of workers falling within the 45-54 age bracket.

The study identifies critical gaps in Lebanon's agricultural trade. Even though imports saw a substantial decrease in 2020 due to the pandemic and devaluation of the Lebanese pound, and exports were chiefly to the Gulf region and the European Union, knowledge deficits about export chains and limited data on specific imports and exports pose strategic formulation challenges.

Regarding food security, the report uncovers that multiple ministries share the responsibility of ensuring food security. However, despite existing strategies and international engagements, there are significant gaps and challenges in devising a comprehensive national food security plan. Notably, a lack of data on national food consumption per capita and food types is apparent, and no single committee encompasses all relevant governmental bodies.

Future Prospects and Challenges in Lebanon's Agricultural Sector: Despite the identified challenges, the Lebanese agricultural sector harbors substantial promise. Nevertheless, the repercussions of the ongoing financial crisis and the COVID-19 pandemic, coupled with political instability and international factors, present substantial hurdles for its growth.

Key Findings from Stakeholders' Insights: A meticulous needs assessment for Lebanon's agricultural sector was conducted in this chapter. By combining in-depth interviews with stakeholders and a scientific analysis of plant samples, the chapter creates a robust understanding of the agricultural landscapes. This comprehensive understanding illuminates the sector's need for up-to-date agricultural data, quality control standards, and governmental support. This section brings to light diverse perspectives within the agricultural sector. It underscores the importance of farmer education, improved communication, access to up-to-date agricultural data, and the role of government, notably the Ministry of Agriculture, in providing adequate support and guidelines to the sector.

Cultivating Practices; Farmers' Challenges: Farmers, primarily reliant on traditional methods, face several challenges. Their adaptability skills, however, demonstrate resilience in coping with economic hardships. Despite these challenges, farmers shoulder the responsibility of maintaining quality and safety due to an absence of explicit enforcement from the Ministry of Agriculture. This study highlights the importance of bridging the gap between farmer practices and expert suggestions, emphasizing the need for comprehensive quality standards and guidelines.

A Roadmap for Sustainable Agriculture: The roadmap for agricultural sustainability and efficiency in Lebanon introduces a cohesive framework of recommendations, thoughtfully partitioned into three sections, aligned with the distinct roles played by the government, farmers, and society. This multi-faceted strategy harmoniously aims to elevate Lebanon's agricultural landscape, fostering a dynamic and enduring sector that thrives in both prosperity and sustainability.

The guideline emphasizes nine critical focus areas:

- Data Collection: Addressing the need for accurate and updated data for informed decision-making.
- Infrastructure: Identifying enhancements to support agricultural activities.
- Food Safety: Ensuring quality control and safety protocols to protect consumers.
- Food Security: Strategizing to guarantee sufficient, safe, and nutritious food.
- Economic Considerations: Analyzing economic factors and suggesting viable solutions.
- Evolvement and Sustainability: Focusing on continuous growth and sustainability.
- Stakeholders' Coordination: Facilitating coordinated efforts among government, farmers, and relevant stakeholders.
- Information Sharing: Creating a suitable platform and systematic for sharing needed information.
- Regulatory Framework: Recommending reforms and setting new ones to foster an enabling environment.

The interconnected recommendations encompass agro-production, which prioritizes diversified cropping and sustainable irrigation practices, working synergistically to enhance soil fertility and preserve water resources. This collaborative approach is interwoven throughout the entire strategy, uniting various sectors to tackle complex challenges. Moreover, a steadfast commitment to environmental compliance serves as the bedrock. This commitment is upheld through regular consultations that integrate local perspectives, enriching decision-making with invaluable cultural insights. For example, effective crop management, ethical dispute resolution, and the adoption of eco-friendly practices contribute to the fabric of sustainability.

Additionally, emergency response teams and feasibility assessments ensure timely support, while gender equality, innovation, and international collaboration collectively propel progress and innovation.

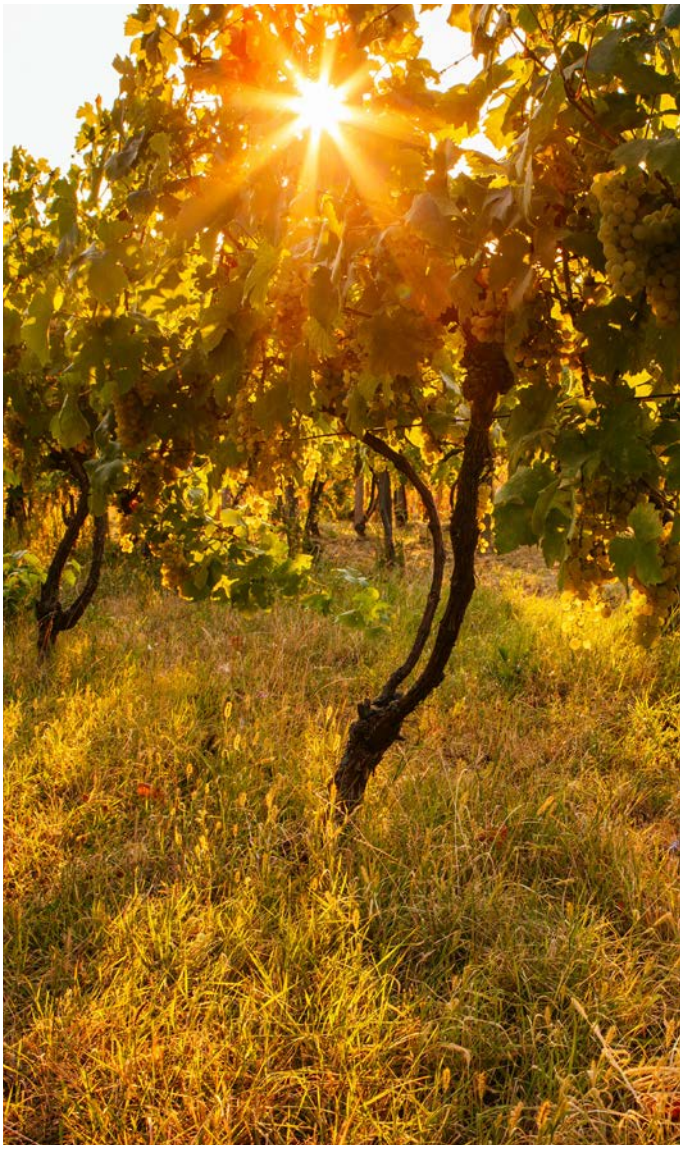
The roadmap directs responsive actions tailored to evolving consumer habits, underscoring the significance of awareness campaigns and waste reduction strategies to gradually nurture a resource-efficient food system. Transparency in labeling fosters a shared sense of responsibility, acknowledging both consumer rights and obligations.

Furthermore, the ascent of farmers' cooperatives as dynamic resource-sharing platforms is fortified by effective crisis management strategies, guaranteeing uninterrupted operations even in adversity. Subsidies and grants incentivize sustainable practices, with unwavering support for local agriculture enhancing both economies and communities.

Education is a key focus, equipping forthcoming generations to seamlessly embrace sustainable practices. Shared responsibility is activated through research advancements, scholarships, and strategic planning. Within this interconnected landscape, monitoring, online platforms, policy advocacy, reform, and ethical responsibilities converge to empower informed decision-making. Public involvement and awareness campaigns spur collective responsibility.

These intertwined elements work in unison to propel the sectoral progress.

Main Intakes of the Study: The study ultimately leads to the conclusion that Lebanon's Agriculture Sector must focus on quality over quantity to ensure food security. The immense potential of Lebanese quality agriculture can, if utilized effectively, result in high returns, thus creating significant leverage for the Lebanese economy. By focusing on quality and adhering to the outlined roadmap, the agriculture sector can mitigate food security risks and contribute to socio-economic growth in Lebanese society.



Introduction

Introduction

A. Scope of the Study

The study acknowledges the crucial necessity of accurately depicting the current state of this sector, and strives to ensure that all data, insights, and proposals provided align with the true realities of Lebanon.

There exists an underlying understanding that any proposed reforms or developmental strategies must be carefully considered against the backdrop of the existing socio-economic situation, ensuring a keen focus on the potential for self-sufficiency and a conscious effort to avoid exacerbating the country's strained economy.

To fulfil this task, the study carries out a meticulous mapping of Lebanon's agricultural landscape, incorporating a detailed analysis of aspects such as lands, stakeholders, policies, legislations, trade, food security, industries, and markets. The impacts of the prevailing circumstances on agriculture are also investigated in depth, making this section an essential component of the document, and offering a thorough situational analysis of the agricultural industry.

A unique feature of the study is the stakeholder needs assessment, conducted through interviews with farmers, experts, and governmental representatives. This assessment is further categorized into thematic sections including education, farming practices, quality control, safety, labor, development plans, and food security, offering a panoramic view of the agricultural landscape from the perspective of its key players.

Finally, the study presents a roadmap for the future, articulating strategic actions the government can adopt to enhance agricultural practices, infrastructure, quality control, safety, food security, and education. These proposed actions are systematically broken down into specific tasks for the sake of clarity and ease of implementation.

B. Relevance of the Study

In the field of agriculture, a comprehensive understanding of the existing body of literature is crucial for advancing the authors' knowledge and identifying areas that warrant further exploration. Acknowledging the contributions made by previous researchers, this study is positioned as a natural continuum to their work, aimed at extending the understanding of the agriculture field and addressing pertinent research gaps. The thorough review of relevant studies has revealed significant insights into the advancement of agriculture and the relevant practices. By building upon these foundations, this research sought to expand upon the existing knowledge by providing a new perspective, incorporating additional variables, and adopting a holistic approach.

C. Significance of the Study

By identifying the gaps and providing recommendations, the research promotes the adoption of sustainable farming techniques, resource management, and waste reduction, contributing to long-term environmental and economic sustainability. The study provides a valuable roadmap for the government and relevant stakeholders. It covers areas such as government support and policies, market monitoring and quality control, education and innovation, financial support, technology adoption, and capacity development. Recommendations related to diversifying crops, improving storage facilities, and reducing food waste that contribute to a more stable provision of food, even in times of emergencies are mentioned as well. Implementing these recommendations can strengthen the agricultural sector, improve its efficiency, and foster economic development.

In summary, the study's significance lies in its comprehensive assessment of Lebanon's agricultural sector, the identification of challenges and opportunities, and the provision of strategic recommendations. By addressing key issues related to sustainability, food security, policy, and knowledge gaps, the research aims to contribute to the development of a more efficient, resilient, and prosperous agricultural sector in Lebanon. In summary, this study's significance lies in its ability to bridge the gap between existing knowledge and novel insights, incorporating the invaluable contributions of previous research while pushing the boundaries of understanding. By generating new knowledge and offering practical implications, this research aims to foster positive change and contribute to the advancement of the Lebanese agriculture.

D. Target Audience

The study is designed to serve a broad spectrum of audiences, each with unique interests, roles, and responsibilities within the agricultural sector of Lebanon. The target audiences are manifold and multidimensional, a reflection of the complexities and intricacies inherent in this sphere.

Concerned ministries, councils, courts, state representatives, including legislators, policymakers, and local officials, form a key audience for this study. The in-depth analysis and strategic roadmap can assist them in formulating sound policies and regulations and legislate laws that not only support the agricultural industry but also contribute to the overall economic stability and growth of the nation.

Civil society activists, advocacy initiatives, regulatory initiatives, and local actors, renowned for their crucial role in advocacy and shaping public opinion, can leverage the study's findings to prioritize and focus their campaigns, to ensure that their efforts align with the real needs and challenges facing the agricultural sector.

The study also addresses National and International Non-Governmental Organizations (NGOs) and development agencies involved in agricultural development and food security. These organizations can use the study to better understand the current state of the industry, to inform their programs and initiatives, and to facilitate the most effective and impactful interventions.

The academic community, including educational institutions, researchers, professors, and students interested in agriculture and related fields, can utilize the research as a credible source of current data and analysis, thus enriching their scholarly pursuits and contributing to the body of knowledge in this area.

Farmers, the backbone of the agricultural industry, are also a key audience. The study provides them with a comprehensive understanding of the sector's dynamics and guides them towards sustainable farming practices.

Farmer associations, syndicates, and gatherings may also derive benefit from the study as it provides a holistic picture of the sector, helping them advocate more effectively for their members' rights and needs.

Entities within the private sector, especially those with a vested interest in agriculture such as suppliers, agribusiness companies, and potential investors, can use the study to make informed decisions and strategies. The study provides them with a broader understanding of the sector's opportunities, risks, and development prospects.

Finally, the community at large, particularly those residing in rural areas directly affected by the state of agriculture, are considered a vital audience. The study gives them an insight into the systemic issues affecting their livelihoods and proposes actionable steps towards a sustainable and thriving agricultural sector.

E. Objectives

The main objectives of this study are summarized by:

- Develop a Sustainable Investment Framework for Lebanese Agriculture: At the heart of this study lies the intent to devise an integrated framework that illuminates avenues for investment within Lebanese agriculture. This framework is constructed on the bedrock of social, economic, and environmental sustainability, providing a strategic roadmap that encompasses short-term, intermediate, and long-term initiatives. It aims to unravel and address gaps, deficiencies, and underperformance within the sector, fostering an environment conducive to robust investment and progressive development.
- Strengthen Institutional Capacities and Advocate for Efficiency and Accountability: This study undertakes a rigorous evaluation of the role and performance of governmental and non-governmental entities within the sector. By exposing the disconnect between the government's intended role and its actual performance, the study aspires to foster enhanced governance, promoting accountability and transparency within the system. This assessment extends to the needs and input of civil society, farmers, and private sector, where their concerns were voiced, resulting in the formulation of valuable recommendations. The goal is to stimulate a collective responsibility and concerted efforts towards advancing the agricultural sector.

Formulate an Actionable Roadmap for Sectoral Improvement: Converting insights into action, this study aims to deliver a comprehensive roadmap for the sector. This includes carefully devised strategies for improving areas of identified weakness and integrating solutions that can potentially be translated into agriculture-specific policy papers. The roadmap offers clear roles, responsibilities, and governance mechanisms to ensure collective responsibility and concerted efforts to enrich the agricultural sector.. This approach not only seeks to prioritize and achieve the proposed goals but also aspires to facilitate the practical implementation of these objectives among all stakeholders, leading the way towards a more resilient, efficient, and prosperous sector.

F. Applied Methodologies

This study employs a mixed-method approach, combining both quantitative and qualitative methodologies, to ensure a comprehensive analysis of the Lebanese agricultural sector. The methodologies applied include an extensive literature review, qualitative interviews conducted via phone calls, zoom meetings, and physical meetings, and an in-depth analysis of plant samples.

- Literature Review: The study begins with an extensive literature review, encompassing reports and studies conducted by reputable organizations such as the FAO, the Ministry of Agriculture, McKinsey, and the World Bank. These sources provide valuable quantitative and qualitative data, statistical analysis, and insights regarding the agricultural sector in Lebanon. The literature review covers a wide range of topics, including major Ministries and syndicates involved in the sector, mapping of Lebanese agricultural landscapes, policies and legislations, trade agreements, and industry analysis. Primary sources, such as censuses conducted by the Ministry of Agriculture and the Central Administration of Statistics, as well as trade reports provided by the Lebanese Customs Office, are utilized to gather current and relevant data. This comprehensive literature review serves as a foundation for understanding the current state of the sector and identifying gaps and areas for improvement.
- Key Informant Interviews: To gain deeper insights into the sector, qualitative interviews are conducted with stakeholders and experts. These interviews are conducted via phone calls, zoom meetings, and physical meetings, providing flexibility and accessibility for participants. The study engages with government representatives, civil society activists, farmers, farmers associations, syndicates, NGOs, and representatives from the private sector. The interviews are organized into two segments: exhaustive and comprehensive interviews with

stakeholders and experts, and a study of plant samples. The interviews explore a range of topics, including farmers' and experts' perceptions of practices, needs, obstacles, limitations, technology awareness, future projections, systematic practices, and rules and regulations. The interviews also delve into farmers' education levels, frequency of consulting experts, and experts' efforts to disseminate knowledge and assist in farmers' development. The qualitative data collected from these interviews provide valuable insights into the challenges and potential solutions within the agricultural sector. The interviews are guided by predetermined themes and sub-categories, ensuring a comprehensive exploration of key aspects related to awareness, practices, education, consultation, data collection, market study, farming practices, quality control, safety, development plans, food security, labor, and needs. The expertise of the interviewed individuals, ranging from agricultural engineers to entrepreneurs and business leaders, contributes to the depth and richness of the insights obtained.

By employing a mixed-method approach, integrating quantitative data from the literature review and plant samples analysis with qualitative insights from key informant interviews and focus group discussions, this study ensures a comprehensive and well-rounded assessment of the Lebanese agricultural sector. The findings derived from these rigorous methodologies serve as the basis for formulating a roadmap that outlines concrete actions and strategies to enhance the institutional development, accountability, and efficiency of the agricultural sector in Lebanon.

G. Assumptions

The study acknowledges several key assumptions made due to inherent limitations. These assumptions provide a framework for understanding the study's findings within the context of its constraints.

- Impact of Unexamined Societies: It is assumed that the input from societies not examined in this study may not significantly alter the overall conclusions. This is comparable to running a marathon where the effects of every terrain are not measured, but the overall race strategy still holds valid.
- Sample's representation: Although the study acknowledges the potential for variation within the farmer community, it assumes that the selected sample provides valuable insights into the challenges and potential solutions.
- Utilization of Available Data and Sources: Despite the limitations in accessing up-to-date data and challenges in contacting governmental entities, it is assumed that the available data and sources can still offer substantial insights for crafting meaningful conclusions. This assumption recognizes the constraints faced during data collection but maintains that the existing information can provide a foundation for analysis and roadmap development. Similar to navigating a marathon route with an outdated map and limited contact with coordinators, the study assumes that the available data and sources are sufficient to draw valid conclusions.

- Varied Views as a Reflection of Complexity: The varied views that emerged from expert and farmer interviews are considered a reflection of the intricate and multifaceted nature of the Lebanese agricultural sector. This assumption acknowledges the diverse perspectives and challenges inherent in the sector. It is comparable to assuming that differing understandings of a marathon route among participants highlight the complexity of the race.

The study recognizes the existence of data limitations, including gaps and inconsistencies, given Lebanon's current volatile situation. However, it assumes that these limitations and the resulting lack of precise, up-to-date data will not substantially affect the overall conclusions. Instead of perceiving data gaps as obstacles, the study views them as opportunities to enhance the roadmap for the development of the Lebanese agricultural sector.

Chapter I

Assessment and Mapping of Lebanon's Agricultural Landscape

I

Assessment and Mapping of Lebanon's Agricultural Landscape

This chapter delves deep into the intricate details of Lebanon's agricultural landscape, aiming to foster a sustainable and efficient sector. It begins by providing a holistic overview of the sector, shedding light on its significance and the challenges it faces. The chapter then meticulously maps and evaluates the utilization of agricultural land, offering insights into its distribution, methods, and resource availability. It also explores the diverse array of stakeholders involved in agricultural development, including research institutions, cooperatives, governmental bodies, and NGOs, unraveling their roles, contributions, and challenges. Furthermore, it investigates the realm of agricultural policies and legislations, demystifying the regulatory landscape and its impact on farmers and agri-businesses.

The chapter further delves into the dynamics of agricultural trade, examining Lebanon's imports and exports in detail, and identifying opportunities and obstacles for enhancing trade. Additionally, it places great importance on food security, providing a thorough evaluation of its current status and challenges, while emphasizing the responsible bodies and necessary plans to ensure a reliable food supply. Recognizing the inseparable link between industry and agriculture, the chapter explores the role and influence of industries on the sector, encompassing machinery and technology providers, transportation and storage facilities, and input suppliers. Lastly, it addresses the pressing issues facing Lebanon's agricultural sector, such as the financial crisis, political instability, and the removal of subsidies, highlighting their direct impact on the sector's resilience and paving the way for critical discussions on future policymaking.

This comprehensive chapter sets the stage for informed deliberations and strategic recommendations to drive the advancement of Lebanon's agriculture.

A. Preliminary Overview and Potential of the Agricultural Sector

Since 2019, Lebanon has been navigating through an escalating sequence of social, economic, health, and political crises. This state of affairs led to a severe economic downturn, with GDP plummeting by 30% in just two years (The World Bank, 2021). The agriculture sector, previously contributing to 5% of national GDP (Lebanese Ministry of Agriculture, 2020), faced the severe brunt of these crises, with production declining by 15% (Lebanese Statistical Yearbook, 2022).

At the heart of this agricultural crisis are traditional farmers and agro-based communities. These communities, constituting approximately 20% of Lebanon's population (Lebanese Ministry of Agriculture, 2023), are contending with considerable challenges. Global demand for food and agricultural products, forecasted to spike by 50% by 2050 (Food and Agriculture Organization, 2022), exacerbates the pressures on these communities, especially in light of Lebanon's ongoing crises.

Given the current state of Lebanon's economy, the increasing food scarcity, and the soaring costs, the agricultural sector's development is now more crucial than ever. Its pivotal role in ensuring food security and contributing to the country's prosperity underscores the urgent need for swift action in terms of investment and research in this sector.

Notably, despite the existing adversity, Lebanon's potential for agricultural development remains significant. Approximately 60% of its land is suitable for agriculture (Lebanese Ministry of Agriculture, 2023), indicating a substantial capacity to increase agricultural production. In fact, a recent UNDP study (2023) suggests that with the right investments, the country's agricultural output could increase by up to 25% within a decade.

B. Lebanon's Agricultural Landscape & Challenges

Agricultural planning and progressive change necessitate a meticulous mapping of the sector, encompassing fields, pivotal enterprises, stakeholders, associated industries, and pertinent regulations. This section strives to outline the Lebanese agriculture industry based on the data currently accessible.

The World Food Programme's initiative, the 'WFP Lebanon GIS Portal', offers a glimpse into the geographical layout of the agricultural landscape in Lebanon (World Food Programme, 2021). This portal provides data on the boundaries and areas of Lebanon's eight governorates, serving as a basis for sector mapping.

However, there is an unmistakable imperative for a more comprehensive and technically rigorous investigation, specifically within the domain of mapping. Data pertaining to land use, land cover, specific plot details, soil types, and zoning information are all elements that would greatly enrich the mapping, though currently missing. It's worth noting that resources such as the US Geological

Survey Map Viewer in the United States offer extensive, publicly accessible data, providing a contrast to the data limitations currently experienced in Lebanon (US Geological Survey Map Viewer, n.d.).

Despite these data constraints, this section manages to construct a valuable mapping based on available data. This exercise is of utmost importance for it allows the visualization of the current state of the agricultural landscape, the key players, factors at play, and potential opportunities. By shedding light on the physical, institutional, and regulatory landscapes of the Lebanese agricultural sector, this mapping allows for an understanding of the sector's interdependencies. This foundational understanding provides a basis for sound decision-making, aimed at enhancing sustainable and efficient agricultural practices in Lebanon.

While the data may not be exhaustive, this mapping presents a crucial tool that contributes to the pursuit of agricultural sustainability and efficiency in Lebanon. Nonetheless, a more in-depth technical inquiry is warranted to not only enhance collaborations but also to potentially augment the richness of this map, catering to the diverse spectrum of stakeholders within Lebanon's agricultural sector.

1. Agricultural Land Utilization

The acquisition of the number of agricultural fields in Lebanon is the first step in the data-gathering method. Knowing the present number of agricultural lands in use and the number of unused and prospective lands gives a starting point for possible investments in areas that have been neglected, as well as improvements in those that have been attended to. This segment takes a topographic approach to map current agricultural lands in Lebanon, focusing on the distribution of these lands across Lebanese regions, the size of the lands in each region, the number of used, unused, and potential lands, as well as the overall type of soil and climate in each and the potential products to be planted in them in the future.

a. Lebanon's Agricultural Lands

Agricultural lands in Lebanon are distributed along eight governorates, "Mohafazat". These governorates are as follows:

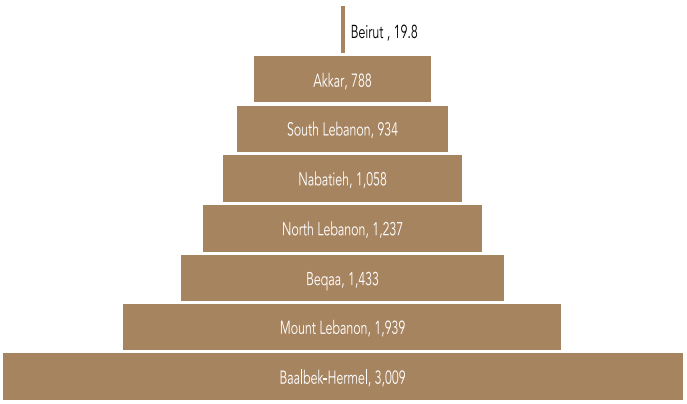


Figure 1: Land Size in Km^2 per Governorate, Source: IDAL, 2018

In this segment, the provided information is sufficient, for the segmentation of regions within Lebanon remains a timeless and constant factor.

b. Soil Composition

Soil mappings are subject to frequent alterations since the surface nature of the soil makes it sensitive to damage and change from toxic substances and environmental changes. The latest thorough mapping of Lebanese soil was released in 2005 in Lebanon. The report of Talal Darwich, an expert in Lebanese soil analysis, was referenced in the following section. Darwich mapped the aforementioned land distributions and classified them into four categories, varying from the best soil for plantation to the worst.

- Class I encompasses the soil that enables the most yield with the least limitations and restrictions upon their use. They are mostly found in the coastal plains as well as the Bekaa valley plains.
- Class II consists of eroded soil and is spread out on the slopes of the South of Lebanon as well as in the Mount Lebanon chain. This type of soil possesses a few limitations, especially regarding plantation methods, on higher altitudes.
- Class III can be found in the areas of arid or semi-arid climates, most often in northern Bekaa fields, Hermel, the eastern mountain chain, and a few coastal areas. Due to harsh climatic conditions, many limitations on the choice of plantation arise, forcing farmers to adopt developed conservation practices more frequently.
- Class IV presides on the steepest slopes of the Mount Lebanon mountain chain and the southern part of the Anti- Lebanese Mountain chain. This class possesses the most restrictions and limitations on appropriate produce to plant as well as land maintenance requirements. Most of these lands are preferably used for recreational purposes or left for forestry.

c. Used Agricultural Lands

The most recent mapping conducted by the Ministry of Agriculture dates back to 2010. In light of recent economic crises, the assumption of there being numerous agricultural lands left abandoned holds great potential of being true. This assumption paves the way for the hypothesis of there being more potential lands to be cultivated. Yet, with no up-to-date details on the matter, the aforementioned hypothesis remains as it is; an assumption. Nevertheless, upon searching for the number of used agricultural lands in Lebanon, the MOA's 2010 census provided the research team with the following details which constitute the areas of cultivated lands.

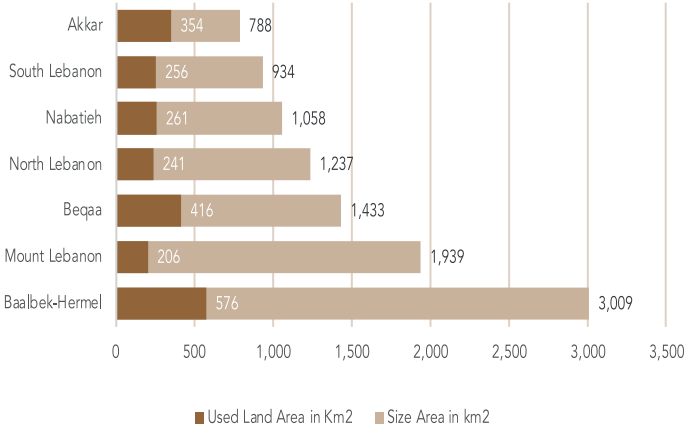


Figure 2: Size of Used Lands per Governorates in Km^2

Additional information was extracted from a study conducted by (Bahn, et al., 2019). The study portrayed that, in 2016, the total agricultural land area amounted to 6580 km2, including temporary and permanent crops as well as permanent crop meadows and pastures. This number demonstrates discrepancies from the one specified by the MOA 2010 census.

d. Unused Agricultural Lands

There are no updated statistics or studies showcasing the number or size of unused agricultural lands in Lebanon. The 2010 census provides the research team with the size of unused parts of land within an overall cultivated agricultural land. It does not detail individual plots of unused lands. Nevertheless, the 2010 agricultural census shows that there is a total area of 216.65 Km^2 representing abandoned agricultural lands, whereas there are 470.27 Km^2 of lands that cannot be used for agricultural purposes and 187.23 Km^2 of lands dedicated solely for forests and forestry.

e. Potential Agricultural Development Lands

It was determined that approximately half of the total land area in Lebanon can be cultivated, with all of the plains, along with the lands in upper elevations in Shouf, orchids lands of Mount Lebanon, the corridors of Rachaya and Hasbaya, and the basins of the South representing the most productive and fertile lands (CDR, 2005). No recourse to recent sources exists to specify how many potentially cultivable lands have gone to waste due to urban expansion, which in turn may have led to the decrease in the number of potentially cultivable lands. However, one source specified that, in 2005, 650 Km^2 of "prime soils" had been turned to concrete for the expansion of urbanized areas (Darwish T., 2012). Such information portrays the ever-present, man-made limitations set on agricultural expansion, yet it remains inapplicable to contemporary times. This leads to reaffirm previous claims about the necessity of there being accurate, detailed, and updated information to construct any reform or development plan.

f. Infrastructure and Irrigation

Irrigation and accessibility to water are the primary factors to take into consideration when making a feasibility plan or simply attempting to invest in the agricultural sector. Even if little-to-no fertilizers or pesticides are used, water remains one of the main components in farming. However, much like in the last three segments, mapping of the irrigated and cultivated lands in Lebanon also dates back to the last MOA census in 2010. In the MOA's 2010 agricultural census, the sources of irrigation are divided into two categories, surface water, and groundwater, with areas closer to the coast-except the South- along with Mount Lebanon relying on surface water, whereas the South -except Bint Jbeil-, along with Bekaa and Baalbek el Hermel rely on underground water.

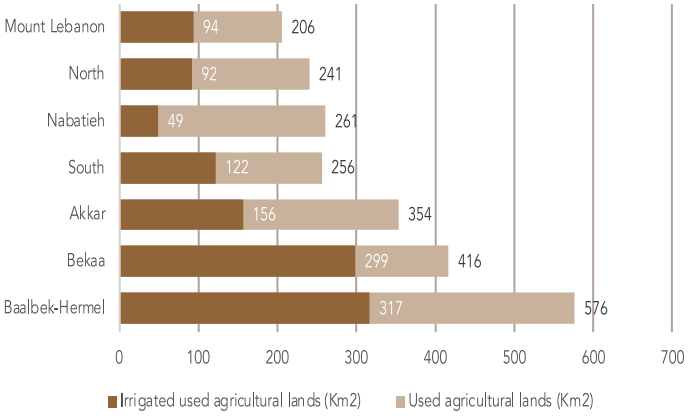


Figure 3: Irrigated Lands in Used Agricultural Lands, in Km^2, Source: MOA census 2010

The division of the land area sizes, based on the 2010 census, goes as followsA core lmitation of the access to irrigation is the absence of proper infrastructure extending from water sources to cultivated land. With the addition of ongoing electrical power cuts and rationing, numerous greenhouses equipped with electrical pump-dependent, drip irrigation systems are facing issues with properly watering their harvest as well, which is significantly decreasing farmers' accessibility to proper and sustainable irrigation. The agriculture sector is the first consumer of water with around 55% to 60% of the utilized water allocated to it. This amount, according to the 2010 census, was able to irrigate half of the cultivated areas. However, according to the projections of the Ministry of Water and Energy, an additional 500 Km^2 area should be irrigated by 2030, which will affect the afore-mentioned percentage.

2. Key Stakeholders in Agricultural Development

Whether legal, financial, trading-driven, research-related, or assistance providing bodies, listing the concerned stakeholders in agriculture along with their roles within the sector provides great guidance for farmers and potential investors alike. This section of the study outlines the numerous stakeholders in the agricultural sector and their contributions.

a. Research Labs

Research labs continuously provide updated agricultural practices that are up to par with international standards and changes. Furthermore, they also provide solutions or guidance to farmers looking for assistance in specific areas varying from plantation methods to exporting or processing procedures.

- Governmental Agricultural Research: Governmental institutions in Lebanon tend to provide services at a reduced price in comparison to the private ones. Thus, governmental research labs have a great role to play in the roadmap towards agricultural development and revival as they are more financially accessible to farmers and people in need of assistance within the field. The study was able to procure the names of the following five governmental bodies responsible for research:
  - Lebanese Agricultural Research Institute (LARI): The LARI carries out applied and primary, basic scientific research in

order to promote the enhancement of the agricultural sector in Lebanon. Moreover, this institute holds close contact with regional farmers and seeks to develop solutions for the problems that they might face.

- Central Administration of Statistics (CAS): This public administration's goal is to assemble, analyze, circulate and generate social and economic statistics at the state level. Consequently, in the field of agriculture, CAS supplies all utilizers with verified demographic information.
- National Council for Scientific Research (CNRS): The CNRS is a pioneer in the Lebanese scientific field that handles all scientific spheres. This institution's essential goal is to incite scientific research and promote the improvement of human resources in the field of governmental, scientific policy-making.
- Industrial Research Institute (IRI): This institute examines and revises industrial research, covering many scopes. This entails scientific trials, calibration, inspection, and certifications (system, product, and personal).
- Investment Development Authority of Lebanon (IDAL): IDAL was founded in 1994 in order to encourage investors and capital holders in directing or keeping their business in Lebanon by appealing, safe-keeping and maintaining their investments.

- Non-governmental Agricultural Research: In addition to governmental bodies, non-governmental organizations play a vital role in research. However, much like the case of governmental labs, there is no singular platform showcasing these labs in an accessible manner, along with relevant information for the farmers and investors, such as locations, contacts, and prices. With the desk review conducted, the following concerned bodies were outlined:
  - Chamber of Commerce, Industry, and Agriculture Beirut and Mount Lebanon (CCIA-BML): This chamber was established for the benefit of the private economy. It provides a multitude of assistance for companies, such as the creation of economic policies and the development of legislation that affects the activity of businesses.
  - Centre de Recherches et d'études Agricoles Libanais (CREAL): This institution conducts studies and provides statistics in the national agricultural sector in an analytical approach, especially when it comes to analyzing food chain processes, from inputs to production, and consumption of merchandise. The data issued by CREAL is credible and has been updated every year since 1951.
  - American University of Beirut Faculty of Agriculture and Food Sciences Research Labs (AUB & FAFS): The Faculty of Agriculture and Food Sciences at AUB engages in wide-ranging research spanning multiple facets of agriculture and health. The research capabilities are segmented into the following specialist facilities:
    - AGRI Research Facilities: This division is dedicated to investigating all areas of agricultural development and sustainability.
    - LDEM Studios: Equipped with state-of-the-art technology and equipment, this studio provides a supportive infrastructure for researchers to carry out groundbreaking discoveries.
    - NFSC Research Facilities (Nutrition and Food Sciences): A unit that concentrates on food-based research, analyzing food compositions and consistency. It houses internationally recognized facilities for specialized food processing.
    - Advancing Research Enabling Community Center (AREC): A community-oriented center facilitating practical, hands-on experience of the meticulous process of food production for its members.

b. Agricultural Cooperatives

Despite the existence of several cooperatives, Lebanon holds an extremely low percentage of participation, with only 4.5% of registered farmers in 2013 taking part in a cooperative as documented in the National Agriculture Strategy of 2015 (MOA, 2015). This traces back to a weak public sector that is unable to support farmers in the case of natural disasters at structural, regulatory, legislative, planning, operational, monitoring, and control levels. Many of these existing cooperatives are shutting down or becoming inactive with the farmers' low enrolment rate as well as the decrease in number of young farmers. These cooperatives also do not have service centers and extensions to apply for and obtain loans. The extracted information above brings to the front many gaps that must be filled with reform on the level of the farmers themselves, as well as society and the government. Such reform will be detailed in the roadmap at the end of the study.

c. Agricultural Holdings

Tracking and updating the precise number of farms and holdings are of the same primary importance as regularly tracking and keeping note of the dispersion of agricultural lands. When tracking farms, the number of investors and workers within the agricultural field as well as the type and scale of investment made were tracked. Thus, numerous characteristics must be taken into account when classifying these farms into various types within the database, ranging from the method of the plantation, the presence of technology and machinery in crop maintenance, as well as the demography of landowners, renters, and workers. However, this segment will not

only see the lack of updated data but the lack of precision and attention to the aforementioned details from governmental and non-governmental bodies alike.

- Temporary Agricultural Holdings: Below is the number of temporary crops divided by a general overview on the type of produce dedicated to each.

Governorate	Cereals (Km^2)	Pulses (Km^2)	Vegetables (Km^2)	Fodder Crops (Km^2)	Industrial Crops (Km^2)
Mount Lebanon	0.72	4.30	15.39	-	0.36
North	8.15	5.29	11.30	0.19	2.03
Akkar	91.41	17.94	76.57	3.05	17.05
Bekaa	156.00	19.42	135.18	8.73	1.09
Baalbeck-Hermel	132.05	35.30	97.04	2.10	34.94
South	18.97	3.93	11.65	0.23	12.85
Nabatiye	42.01	8.36	20.64	1.89	28.67

Table 1: Land Dedication to Types of Temporary Crops per Governorate, Source: MOA census 2010

Further divisions according to types of plants in each holding and region can be accessed on the MOA's 2010 census. However, permanent, temporary, and greenhouse crops must be divided into whether they are dedicated for exports, industries, or local consumption. This information will benefit relevant bodies in to assess and implement food security plans, as well as enhance agricultural revenue by providing insights to reach a data-based decision of what should be the main areas of focus.

- Permanent Agricultural Holdings: Identical to the suggestions and solutions provided for the data tracking and classification of temporary crops, data of permanent crops should be regularly and continuously updated in all of its characteristics and details. The following numbers acquired are from the 2010 agricultural census:

Governorate	Citrus (Km^2)	Pome Fruits (Km^2)	Stone Fruits (Km^2)	Grapes (Km^2)	Olives (Km^2)
Mount Lebanon	2.86	34.91	15.05	10.70	53.92
North	12.25	38.38	22.15	4.79	122.13
Akkar	13.78	17.86	16.29	8.92	99.45
Bekaa	0.02	17.61	35.65	39.45	26.29
Baalbeck-Hermel	0.13	28.73	119.08	36.29	42.05
South	63.62	2.00	1.87	2.79	78.41
Nabatiye	7.28	3.54	7.06	3.15	114.22

Table 2: Land Dedication to Types of Permanent Crops per Governorate, Source: MOA census 2010

- Greenhouse Agricultural Holdings: For years, experts in agriculture have advocated for the technological advancement of farming. Knowing that, in the years prior to the economic downfall of the country, many companies and funding agencies, such as Berytech, have encouraged the utilization and creation of industrial machines for the enhancement of agricultural methods, the possibility of there being at least one or two holdings, especially within greenhouses that are technologically equipped, becomes very likely. Below are the first steps provided in the data documentation as provided by the MOA.

- Open field Agricultural Holdings: The number of open field farms, though not explicitly mentioned in the census summary, can be deduced from simple calculations. Having such a large number of open field farming may present numerous connotations. It can be indicative of a lack of resources to transition to greenhouses. It can also help identify the type of products planted for local or personal consumption.

Regions	Used Agriculture Lands (Km^2)	Greenhouses (Km^2)	Open Fields (Km^2)
Baalbek-Hermel	576.25	5.25	571.00
Bekaa	416.49	4.77	411.72
Akkar	353.52	15.74	337.78
South	256.21	0.86	255.35
Nabatieh	256.21	2.19	258.76
North	240.65	6.28	234.37
Mount Lebanon	205.88	2.93	202.95

Table 3: Total Land Area of Open Field Farming per Governorate, Source: MOA census 2010

As observed in the numbers above, Lebanon adopts more open-field farming than greenhouses. Many factors could be the reason thereof, ranging from the type of to the individual farmer's financial capabilities. With the economic crisis reducing countless farmers' purchasing power, one can assume that open-field farming may have increased in comparison to the years prior to 2020. However, assumptions remain unverified as long as the MOA has not updated its census.

- Size of Agricultural Holdings: In 2010, the below number of holdings were registered and divided into different categories based on the size of the holding. The following chart was issued by the MOA. No explicit criteria signifying what holdings are considered small and which aren't; however, FAO in a report made in 2020 says that all small holdings have an average size of 14,000 m^2 - thus holdings that are smaller than 20,000 m^2 are considered small in Lebanon. Whereas, larger ones represent approximately 30% of all used agricultural lands in Lebanon (FAO2020). These holdings are generally bigger than 200,000 m^2 (FAO, 2021, p.12). Contrarily, in France and during 2016, the average size of small holdings was less than 100,000 m^2, whereas medium holdings ranged between 100,000 m^2 - 500,000 m^2, and large holdings, which constituted the lowest number of holdings, were over 500,000 m^2.

Regions	>10,000 m²	60,000-10,000 m²	200,000- 60,000 m²	500,000 - 200,000 m²	500,000< m²
Baalbek-Hermel	26,710	4,218	200	33	17
Bekaa	21,157	6,105	325	33	16
Akkar	18,105	9,184	756	61	14
South	6,965	4,170	995	264	122
Nabatieh	9,598	9,960	1,640	292	79
North	16,662	4,770	556	99	24
Mount Lebanon	19 668	6 251	394	53	16
Total	118,865	44,658	4,866	835	288

Table 4: Agricultural Holdings by size and by governorate, Source: MOA census 2010

- Bought or rented Agricultural Holdings: The great majority of agricultural lands in Lebanon are owned rather than rented. In actuality, 83.9% of the lands were owned, with 5.9% (9,923 holdings) rented for money and 1.8% (3,031 holdings) rented for a portion of the produce. During that period, 7.8% of total cultivated lands (13,257 holdings) were transitional, although no data defined what were the prior and future uses to be of the lands. When conducting comprehensive statistics on farm distribution and type, it is recommended to include the type of land acquisition, because obtaining this type of information facilitates making to make accurate calculations of the overall cost of land tenure and maintenance, in order to formulate conclusive plans.

- Inherited Agricultural Holdings: The agricultural census conducted by the MOA did not clarify whether "ownership" of the lands was gained by inheritance or purchase. As a result of the above remarks, it was established that no strategy can be fully defined and executed without current data providing specifics on prospective expenditures incurred by landowners, or the absence thereof. Furthermore, data such as the number of inherited lands in use vs rental lands in use will allow the investigation of specific patterns in each scenario and building successful plans for both to develop their output.

d. Public Administration & Agriculture

Any company, institution, or holding whether private or publicly owned must operate under governmentally set policies and regulations first. Thus, any person wishing to enter the agricultural sector, in any form or field (agro-industrial, agri-food, etc...) must be aware of the responsible and relevant public administrations. The following section overviews the accountable administrations.

- Involved Ministries: In Lebanon, numerous ministries work in cooperation for the enhancement and operation of the agricultural sector. However, the plurality of these governmental bodies poses itself as a double-edged sword, especially in terms of administrative processes and the complications arising from them. When searching for these governmental bodies, there was also no singular platform from which to extract them all or explain the role of each when it comes to the operation of the agricultural sector. Contrarily, the French government explicitly mentions all of the bodies concerned in the agricultural sector on their official, governmental website. Thus, conducting multiple searches as well as contacting experts from different areas in the agricultural sector was necessary to pinpoint the following bodies as well as their roles (except that of the MOA itself):
  - Ministry of Agriculture (MOA): This ministry is responsible for helping farmers and managing their affairs when needed as well as establishing and implementing programs and policies. They also follow through in making sure that these new policies and programs are implemented.
  - Ministry of Energy and Water (MEW): This ministry has a vital role that comes hand in hand with the work of the Ministry of Agriculture. They have a major goal of establishing and implementing programs for the safe and sustainable utilization of water sources as well as making energy from water for agricultural practices.
  - Ministry of Industry (MOI): The MoI works closely with the Ministry of Agriculture in transforming products from raw into processed ones. Therefore, this Ministry oversees the safe development and implementation of agriculture-related innovations as well as the varied agri-food related processes.
  - Ministry of Finance (MOF) and Ministry of Economy and Trade (MOET): These two ministries work closely together in order to regulate the import and export of agricultural inputs and outputs. They also track and document the revenue of the agriculture sector as a whole.
  - Ministry of Public Health (MOPH): The MoPH takes care of the consumer by making sure that the products and inputs made or imported are safe for consumption and use. Thus, they oversee the preservation of good quality and safe production that is compatible with international food safety and nutrition standards.

- Involved Institutions: Access to comprehensive information about agricultural institutions is somewhat limited on the MOA website. This poses a challenge for new investors who need detailed data to make informed decisions. Here are brief summaries of five key institutions:
  - Central Administration of Statistics (CAS): The role of this institution is previously described in the document.
  - Lebanese Agricultural Research Institute (LARI): The purpose and functions of this institution are defined in earlier sections.
  - National Council for Scientific Research (CNRS): Details regarding the functions and responsibilities of this organization are already outlined.
  - Investment Development Authority of Lebanon (IDAL): Information regarding this institution's role is provided in previous sections.
  - Lebanese Standard Institution (LIBNOR): LIBNOR is responsible for setting quality standards for agricultural food products, including processing protocols. It outlines product dimensions, conventions, symbols, and quality definitions. It also prescribes guidelines for testing and analysis methods for both edible and non-edible items and delineates professional codes of practice.

- Green Project (MOA, Green project): Established in 1965, the Green Project reclaims agricultural lands to facilitate proper investment and cultivation by farmers. In addition, it provides education and support for environmentally friendly farming practices. The Green Project has been conferred with unique administrative and financial powers to fulfil these responsibilities.

e. NGOs in Agriculture

With the increasing depreciation of the value of the LBP, even the MOA had to have recourse to funding from international NGOs to support its farmers in the purchasing of agricultural inputs, since August 2020 (FAO, 2020). The Chamber of Commerce, Industry, and Agriculture of Zahle created a mobile application named, Agvisor, containing a relatively detailed directory full of numerous names of relevant NGOs. However, the lists are not clearly divided into national and international organizations, nor does it provide information on the role and contribution of each. Thus, much information is missing in the segments below. Contrarily, the FAO report of 2021 was able to provide a description and role of relevant NGOs and donors that have presented many contributions to the agriculture sector.

- National NGOs: Some of the national organizations that have been renowned for their contribution to the agricultural sector are:
  - Renee Mouawad Foundation (Renee Mouawad): The RMF is named after the former Lebanese president of 1991. It started as a low-ranking organization and increased its footprint to become a regionally recognized NGO. The RMF's mission is to expand social, economic, and rural development in Lebanon with the partnership of many national and international organizations. Rural development projects targeted individual farmers, whether in the agricultural, dairy, or the agri-food sector.
  - Emkan NGO: This local nongovernmental association was initiated in 2008, in association with Bank Med. This organization, like the RMF, strives to strengthen the Lebanese economy through the development of the agricultural sector. It provides microloans to rural communities and farmers. It also inaugurated a wholesale market in Akkar called Souk Akkar in 2014 to benefit farmers and traders in that area in order to reduce post-harvest losses.
  - Lebanese Association for Urban Agriculture (LAUA): The LAUA is the linking force between several international organizations and the Lebanese agricultural sector. They seek to restore environmental balance by making use of small areas in cities for agricultural purposes; thus, widening the output and proceeds of the agricultural sector.
  - Soils Permaculture Lebanon (Soils Permaculture): This association propagates and implements sustainable agricultural approaches for environmental conservation, by targeting waste management, community building, and energy conservation. It tries to achieve this by providing training as well as a certificate course on sustainable permaculture design to farmers, engineers, and consultants.
- International NGOs and Development Agencies: The most notorious international organizations that have funded and contributed to the development of agriculture in Lebanon are:
  - Food and Agriculture Organization (FAO): This international organization was established in 1945 as an agency under the United Nations. Its aim is to defeat hunger and provide food security in the world. FAO works on implementing agricultural and rural development policies and projects at the core of national development efforts in order to fight poverty and generate opportunities that are not limited to farming. The FAO has funded countless agricultural projects in Lebanon whether they be implemented by the Ministry of Agriculture itself or local and international NGOs.
  - United States Agency for International Development (USAID): This organization was founded in 1961. Their aim is to ensure worldwide Food security by aiding families and individuals in acquiring their basic, quality nutritious needs as well as financial resources. USAID projects ensure that not only agricultural products are produced but that they are produced using safe and high-quality practices. Many international organizations contributing to the agricultural sector in Lebanon include the UNDP, WFP, UNESCWA, the Association of Volunteers in International Service, European Spatial Development Planning Network (ESDP), Mercy Corps, and many more Italian, Norwegian, Danish, German, and French donors.

f. Lebanon's Agricultural Workforce

The agricultural sector requires manpower in order to function properly, whether that of laborers or of the holding owners. Different organizations and bodies have attempted to conduct demographic studies and estimations regarding this topic. The International Labor Organization (ILO) has estimated that the number of people employed in the agricultural sector was 1.3 billion workers worldwide (ILO, 2023), whereas the CAS census of 2018-2019 determined that 3.6% of the employed labor force is centered in Agriculture, forestry, and fishing. Therefore, with different sources portraying vastly different values, the results of the 2010 agricultural census conducted by the MOA were portrayed. The gaps in the data collection, which neither the MOA nor other bodies took notice of the filling, are also highlighted.

- Laborers in Agriculture: Manual labor is an essential part of agricultural practices. This segment highlights the most important demographic information related to laborers within agriculture in Lebanon, such as nationality, gender, revenue, and benefits.
  - Lebanese: The MOA census data pertains to agricultural holdings operators and the full-time as well as seasonal labor conducted by their family members, assuming that all agricultural land operators or holders are Lebanese. Thus, in that case, in 2010, the agricultural sector employed 165,594 people who are related to family members of holding

operators for full-time work and 239,007 family members for seasonal work. The census does not cluster them by gender, nor does it determine their income and social security benefits.

- Foreign: No governmental or international sources have determined how many foreigners work in agriculture, along with their type of work, income, nationality, gender, and legal status. Upon looking at secondary sources, a study conducted by Hamade (2013- 2014), showcased that many of the agricultural laborers in Lebanon are workers of Syrian nationalities, with half of these laborers being women. These permanent workers work and live on the agricultural land and have minimal rights since most of them are employed informally and benefit from no amenities or security. Furthermore, no census was conducted to determine how many laborers, both national and foreign, work on percentage-based income and how many work for a stable revenue, either monthly or daily.

- Land operators in Agriculture: Both genders of operators are most commonly aged between 45 and 54 years old. The census does not provide the average revenue of these operators. However, in terms of benefits it showcases that, out of a total of 169,512 holding operators, those with social security totaled 42,334 people, while those without social security constituted a grander majority of 126,688 people. This proves further again how the agriculture sector is a largely informal one, as it enforces no taxes on farmers or laborers, and, thus, provides them with no security at the state level.

- Workforce educational background: There exists no database or census showing the educational level of people working within the agricultural sector, whether they be seasonal laborers, full-time workers, landowners or farmers. The only rough retrievable estimation was from (Bahn, et al., 2019) study, in which it was determined that 61% of farmers have received primary-level education, whereas 16% are illiterate. Nevertheless, Lebanon holds many educational institutions dedicated to teaching aspiring students in the agricultural field. These institutions are divided into two parts; the first one is technical schools and the second is at the university level. The technical schools are under the jurisdiction and management of the Ministry of Agriculture. The American University of Beirut, the Lebanese University, The Saint Joseph University, The Balamand University, and the Holy Spirit University of Kaslik are the only higher education institutions providing degrees in the field of agriculture.

g. Experts in Agriculture

Experts are an essential component for the development and progress of the agricultural sector. They provide both technical assistance to farmers facing problems with their production and continuously research and design better farming practices, whether financially or environmentally. According to the MOA's 2010 agricultural census report, 11% of total landholders have benefitted from technical guidance and assistance, of which 82% was provided by private sector companies. A total of 22% of total agricultural holdings in Lebanon had been enhanced by the assistance of agricultural experts (MOA & FAO, 2010).

- Professional Assistance in Agriculture: In terms of public institutions, LARI is the institute that is providing the most technical and informational assistance to Lebanese farmers. However, with the private sector possessing the most influence over the Lebanese agricultural sector, below are some of the companies and institutions that provide professional assistance to farmers.
  - The Federation of Chambers of Commerce, Industry and Agriculture (FCCIA): This federation organizes and unites the four main chambers for the purpose of pinpointing the most essential and common interests of national and international institutions as well as that of the Lebanese government, rendering it as Lebanon's most important lobbying group. In the field of commerce, industry, and agriculture, the FCCIA provides numerous and dynamic services and discusses the economic issues of these sectors with external or international parties.
  - Debbane Group (Debbane Group): This company provides several agricultural services and inputs, such as seed and crop protection and forage, fertilizers, greenhouse materials, and shade nets. It also provides and installs irrigation systems, imports and sells agricultural equipment, as well as machinery. Furthermore, they give agricultural consultations and management, post-harvest services, and biological solutions to farmers in need. Thus, Debbane Group, more specifically Debbane Agri, is an extensive service, expertise, and input provider for farmers in Lebanon.
  - Natagri (NATAGRI): This company strives to develop sustainable agricultural systems that will enable them to make a breakthrough in international markets. Additionally, they provide a multitude of services and inputs to farmers. Services include agricultural project management, quality control, consultancy in professional training, and market studies. Moreover, this establishment provides post-harvest services by connecting farmers with local and international distributors.
  - Comptoir Agricole du levant S.A.L (Comptoir Agriculture): This company was founded by Dr. Fouad Saadé. It provides agricultural and horticultural inputs, equipment and

machines, fertilizers, insecticides, fungicides, bactericides, herbicides, irrigation, and water treatment systems. In terms of services, they offer engineering and pest management services, mirroring much of the previously mentioned inputs and services provided by other companies. Thus, it was observed that many agricultural input companies act both as input providers and expert assistants alongside already established expertise providing institutions.

- Individual Experts in Agriculture: In terms of singular experts, individual agricultural engineers can be searched for and accessed on the platform of the Order of Engineers and Architects. However, each engineer's description does not incorporate his/her rank, area of specialization, or years of experience. Thus, though providing access to the contact information of freelance experts, the Order of Engineers and Architects does not efficiently classify or organize them.

h. Financial Support in Agriculture

A major hindrance to the sustainability of the agricultural sector in Lebanon is the lack of access to financial assistance. Since and even prior to the systemic financial crisis, farmers have had recourse to asking non-governmental organizations for financial assistance. These measures have increased tenfold since the onslaught of the economic crisis, for many of the other funding financial institutions had ceased to provide loans and other modes of financing. This section the main financing bodies of the agricultural sector as well as their methods of financing prior to and post-economic crisis.

- Credit Access for Farmers: In 2010, only 1% of recorded land operators admitted to having access to agricultural credit from financing institutions. This 1% occupied 3% of total land areas (MOA & FAO, 2010). In this segment, all institutions that have financed and micro-financed agricultural projects will be highlighted. Kafalat is a financial institution stemming from the National Institute for the Guarantee of Deposits and Lebanese Commercial Banks. Kafalat's main purpose is to provide loan guarantees to banks offering loans for the sectors of agriculture and industry (FAO, 2020). Additionally, there exist approximately 20 other institutions providing microloans, ranging from 300 to 7,500 US dollars to Lebanese farmers (Wahidi, 2017). One particular micro-financing institution (MFI), Tanmiyat al Rouwad, reached a peak of USD 13,000 in singular microloans in 2015. Most of these microfinancing institutions are NGOs or anonymous Lebanese companies that offer interest rates ranging between 12 to 16%, a much higher interest rate than that of the Kafalat. When implemented correctly, some cooperatives also provide financing to farmers, through in-kind loans, such as price reduction on tools and inputs in return for a percentage or reduction on the output sold within the cooperative (FAO, 2021, p.33). Thus, prior to the double crisis, Lebanese farmers had multiple opportunities to acquire the needed financing for their profession from financial institutions, cooperatives, and MFIs, yet very few went for these opportunities.

- Funding sources of Agricultural Projects: Other styles of funding were begotten from funding institutions, most notably international ones (IFIs), and bilateral donors. Both of these presents themselves as the most common funding bodies in the Lebanese agricultural sector. The FAO has provided financial and technical support to the greatest number of projects implemented in Lebanon, whereas the German development bank, KfW, has donated the most funds (FAO, 2020). In this section, all of the information that will be presented below pertains to international donors of different origins.
  - Countries: There are many different countries funding Lebanese agricultural projects through either their governmental bodies or development agencies, most of which are European, such as France, Germany, the Netherlands, and Italy. The German government acts through its development agency, Gesellschaft für Internationale Zusammenarbeit (GIZ), a non-profit private company. (FAO, 2021, p.36). Additionally, France has presented its support through the Agence Française de Développement (AFD). The AFD has focused its initiatives on rural communities, aiming to enhance their development and promote agricultural activities within these areas (FAO, 2020). Similarly, to the AFD, the Italian Development Cooperation has been targeting rural communities and farmers within these communities for water management projects. Working in collaboration with NGOs, educational and water management institutions, and governmental bodies, the Italian Development Cooperation has extended the reach of its projects to many Middle Eastern countries, including Lebanon. Finally, spurred on by the impact of the Syrian crisis on Lebanon, the Government of Netherlands, in collaboration with the FAO and Green Plan, funded numerous projects targeting the enhancement of refugee livelihoods and food security (FAO, 2020).
  - United Nations organizations: The Food and Agricultural Organization of the United Nations is the international organization that has assisted the Lebanese Ministry of Agriculture in the largest number of projects targeting the agricultural sector in Lebanon. Following a joint Country Programming Framework (CPF) with the MOA, the FAO works on solving issues according to the priorities outlined in the ministry's National Agricultural Strategy of 2015-2019 and the Lebanon Crisis Response Plan/Food Security Strategic Response Plan of 2017-2020. The CPF was also

able to accomplish all of its objectives while promoting the exchange of information and reducing gender inequalities within the agricultural sector as well. Some of the projects implemented include improving Lebanon's agricultural technical schools (MEDRESET, 2018). Moreover, according to the 2020 FAO report, this IFI also established a CPF with Lebanon on July 14, 2016, for the years 2017-2022. This CPF, however, focuses more on the creation and increase of economic opportunities and human capital. It also works on increasing the quality of said opportunities. Moreover, the International Finance Corporation (IFC) places most of its investments in the private sector to increase access to employment opportunities and the economic expansion of this sector. However, though the World Bank's direct contributions to the agricultural sector are not many, it has significantly contributed to Lebanon's mitigation of the Syrian refugee crisis by allocating exceptionally large amounts of funds and creating trust funds composed of several donors (FAO, 2020).

- European Union delegation to Lebanon: The European Union signed an agreement with Lebanon in 2002 that has, since then, enabled a delegation of this union to increase its cooperation with Lebanese ministerial and governmental bodies through projects and plans implemented in civil society agencies and academic institutions. This delegation tackles issues of water management and conservation. Projects falling under this category increased significantly since the Syrian crisis, due to the increasing scarcity of water in rural communities for these refugees. It has been recently working in collaboration with UNICEF and the Ministry of Energy and Water to solve the issues of water leakage and reduce water waste (MEDRESET, 2018).
- International Fund for Agricultural Development (IFAD): IFAD has been consistently engaged in mitigating rural poverty by fostering agricultural opportunities through development initiatives and enhancements in rural areas. It focuses specifically on small-scale farmers and people living in harsh poverty as a result of the Syrian crisis in the early 2010s. Most of their current projects target the upgrade of agri-processing and marketing activities within the aforementioned communities. Some of the large-scale projects that IFAD has implemented have reached budgets of USD200 000 (FAO, 2020).

3. Agricultural Policies & Practices in Lebanon

This section of the study outlines numerous policies or legislations that set the structure of the agricultural sector. It is important to keep in mind that the main focus here is the agricultural sector itself and not the agri-food sector.

a. Agricultural Practices

The Ministry does not force any laws or specific protocols/ procedures upon farmers; it provides incentives and training on the best farming practices. This includes techniques of crop rotation, water management, and fertilizer and pesticide utilization. These incentives most often come in the form of training programs. Nonetheless, the only form of law set in place for agricultural practices is the ban of harmful pesticides. The list of banned pesticides is updated regularly, as seen in recent bans dating from 2020 and re-authorizations dating from 2021, and has been implemented since 1998. The full list can be accessed on the MOA's website. When it comes to monitoring the implementation of these bans, the MOA has been reported to neglect this responsibility, except in cases where agricultural products are being examined for exportation.

b. Workers' Rights and Duties

Workers, especially independent farmers and laborers, in the field of agriculture, are not subjugated to rules or policies, as they are not registered by the Lebanese government and do not pay taxes. This immediately excludes of the scope of Social Security, prohibiting them from any health benefits. However, farmers working on company-owned plots, or in agriculture-related companies, are registered as full-time workers under said company and get to benefit from social security as well as pensions. This portrays that the agricultural sector is largely considered unregulated. In terms of employing foreign laborers or workers, generally, these laborers must already have acquired a permit from the Ministry of Labor to take part in any work in Lebanon. However, if any employer is to hire a full-time, salaried, non-Lebanese worker, they must send a document to the Ministry of Labor in which they state their approval on the reception ofsaid laborer (IDAL, 2020). This is most notably observed in the case of private companies as well.

c. Quality Standards

The Ministry of Agriculture doesn't monitor or require a unified standard of quality. This is especially true when it comes to products that are sold in Lebanon. The only governmental institution setting clear quality standards and protocols is (LIBNOR); however, it targets the agri-food industry more so than raw agricultural products and the farming process behind them. More often than not, private companies are the ones that make regular audits and set specific quality standards for farmers operating with them. One such company is the Control Union in Lebanon, offering the Global G.A.P., which conducts regular and yearly audits from both national auditors and international auditors.

d. Trade Agreements

Lebanon applies import duties of 70% on fresh produce that is offshore planted and harvested. Only imports from the EU or Greater Arab Free Trade Area (GAFTA) are exempted from these high duties, for it has established multiple trade agreements with them. In the Arab regions, Lebanon has been a member of the Greater Arab Free Trade Area ever since its enactment in 1998. However, in the case of product exportation, the reduced duties and special treatment in all of Lebanon's trade agreements are suspected to manipulation by

political factors. For instance, in April 2022, Saudi Arabia imposed a ban on Lebanese Agriculture products, raising fears among Lebanon's struggling farmers and impacting the whole Gulf market. Beyond Arab regions, Lebanon has established FTAs with Western countries, most notably the Trade and Investment Framework Agreement (TIFA) with the United States, an FTA with the EU (EFTA - European Free Trade Agreement), and other trade agreements with the EU. Trade agreements with the EU had promised to provide concessions on other products, such as potatoes, but have not been completely enacted as of yet, according to the MOA's 2020-2025 National Agriculture Strategy (NAS) (2020). Multiple bilateral trade agreements have been established with non-Arab and non-EU countries, some of which are no longer ongoing.

4. Lebanon's Agricultural Trade Analysis

This segment reveals trade statistics of the agricultural and agri-food sector which determines its competitiveness in international markets. The statistics have been extracted from two sources: the Lebanese customs website as well as the ITC Trade Map website. The most recent general imports and exports information encompass statistics from 2021.

a. Agricultural Import Profile

The year 2020 marked a notable decline in general imports, with the value dropping to 11.4 million USD. This significant decrease can be attributed to various factors, including the impact of the COVID-19 pandemic and the devaluation of the Lebanese pound. The numbers went up in 2021 and 2022 compared to 2020. This might indicate increased demand for goods that are not readily available or produced locally. It may indicate a growing consumer market, evolving consumer preferences, or a need for specific products that cannot be adequately met by domestic production.

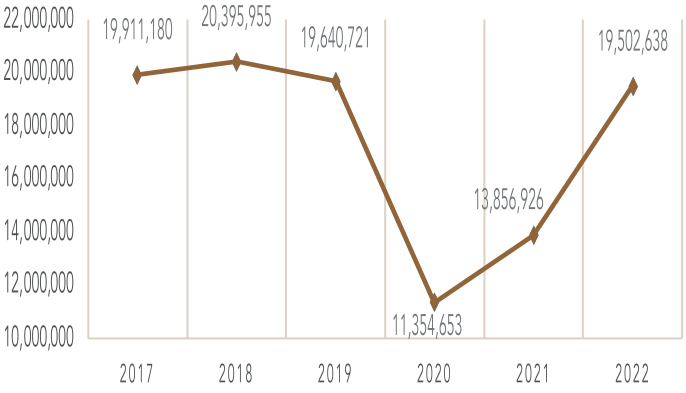


Figure 4: Fluctuation of General Imports Value

- Agricultural products: The amount spent on agricultural imports has also dropped in 2020 when compared to prior years. However, the drop in the value of agricultural imports in 2020 was relatively small compared to the decrease in net weight. This could suggest that Lebanon focused on importing essential products or sought cheaper alternatives, resulting in a smaller decrease in value compared to the volume of imports. However, the increase in the value of agricultural imports in 2021 and 2022 indicates a potential recovery or a shift towards higher value imported agricultural products. This could be due to factors such as increased consumer demand, or changes in import preferences. The decrease in net weight of agricultural imports in 2021 and 2022 suggests a declining volume of imported agricultural products. This could be a result of various factors, including changes in consumption patterns, supply chain disruptions, or efforts to promote local production.

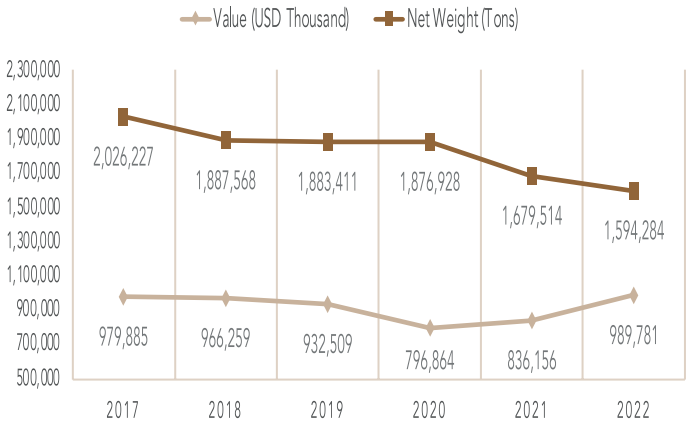


Figure 5: Fluctuation of General Imports of Vegetable Products Value and Net Weight, Source: Lebanese customs- Annual Statistics of General Imports of Vegetable Products (HS2), 2022

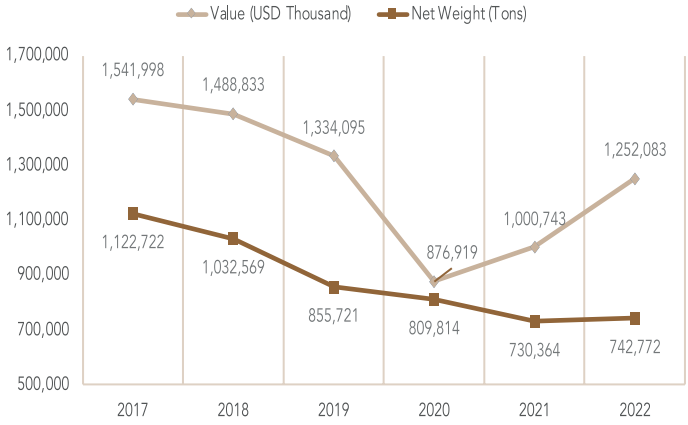


Figure 6: Value and Weight Fluctuation of Processed Foods Imports, Source: Lebanese Customs- Prepared foodstuffs, beverages, tobacco incl Animal or vegetable fats and oils (HS3 and HS4), 2022.

Lebanon mainly imports vegetable products from Egypt, Syria, China, and Turkey, as well as Western European countries like the Netherlands, France, and Belgium. Whereas fruits are mainly imported from Iran, the USA, Turkey, Vietnam, Saudi Arabia, Syria, and Egypt.

Further information related to each products' monthly import figures can also be accessed on both the ITC Trade Map and the Lebanese customs' website, though figures from 2023 remain incomplete on the Lebanese customs, and thus, non-transferable to the ITC one.

- Farming tools: Agricultural farming tools are not placed in an overall category of their own but were combined into the tools and cutlery category with other non-agricultural, handheld tools. Thus, what will be portrayed in the figure below will only be one small subcategory of numerous agricultural machinery that could not be combined into one single division of their own.

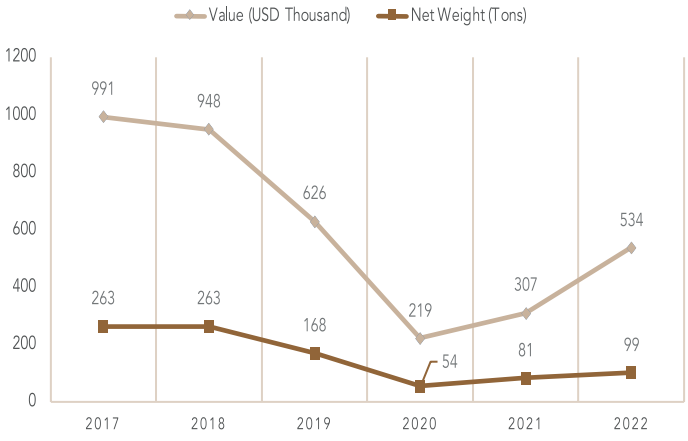


Figure 7: Yearly Fluctuations of Farming Tools Imports Value and Weight, Source: Lebanese Customs, General Imports of Hand tools (shovels, mattocks, hoes, spades, etc...., 2022).

- Seeds: Most data on seed imports are held within the private agricultural input companies acquiring them. When searching through the ITC and Lebanese customs websites, the only data pertaining to planting seeds revolve around potato seeds. Upon interviewing experts from agri-food companies, this information was stated to be confidential, and thus, inaccessible.

- Fertilizers imports: The main exporting countries of fertilizers to Lebanon include Belgium, Spain, Italy, Netherlands, Russian Federation, Greece, Turkey, China, and Egypt. The decreasing trend in the net weight of fertilizer imports, particularly in 2021, indicates a decline in the volume of imported fertilizers. This decrease in net weight could be due to factors such as reduced agricultural activities, shifts in local fertilizer production, or changes in farming practices that require less fertilizer usage.

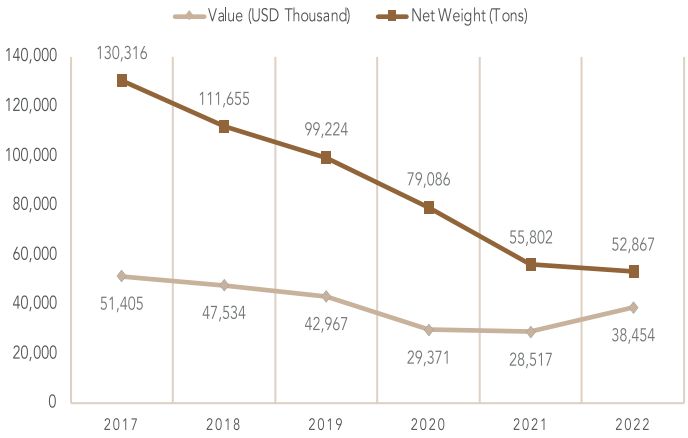


Figure 8: Values and Weights of General Imports of Fertilizers, Source: Lebanese Customs- General Imports of Fertilizers (Yearly Figures), 2020.

- Pesticides: Though no official and reliable resources have determined the extent to which governmental bodies are actively monitoring the nature and components of imported agricultural inputs, a few articles have exposed instances in which such interventions were made. According to Al Hayek (2015), the MOA exposed the presence of harmful pesticides and chemical-induced agricultural products after answering reported suspicions. Such an instance, though expressed in news sources, highlights how governmental bodies mainly rely on reporting and findings from citizens to conduct most of the quality control checks on agricultural inputs.

b. Agricultural Exports

Though imports heavily overshadow exports, Lebanon still sends many of its local productions to key and important markets, most notably those in the Gulf region and EU.

- Agricultural products: With its geographic placement easily extending its reach to the Gulf and European countries, as well as the trade agreements and relations established with both, Lebanon benefits from access to significant international markets for agricultural product exports. This can be observed from the steady increase in exportation revenues over the time frame of 2017 - 2022 displayed below.

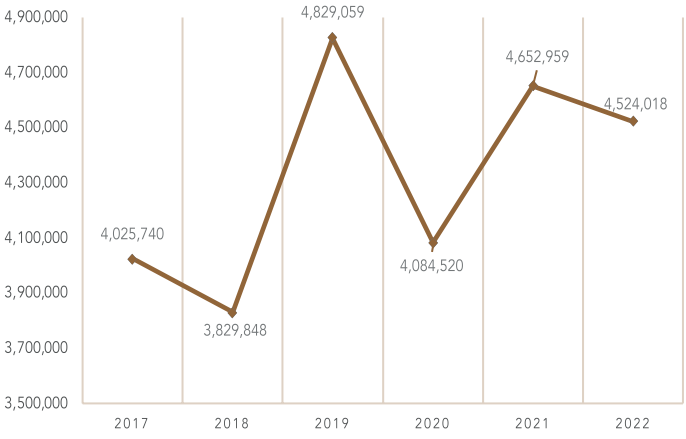


Figure 9: General Total Exports, Source: Lebanese Customs- Total General Exports, 2022.

As observed in the net weight exported in 2018 and 2019 and correspondent values, Lebanon was able to export fewer amounts of agricultural output for a higher value. This, of course, depends on the type of products exported as well as their quality. Nevertheless, these figures provide a great example of what the agricultural sector in Lebanon can achieve.

Furthermore, the main importers of Lebanese fruit and vegetable products are Gulf countries as well as neighboring countries in the Arab region, including Syria, Kuwait, the UAE, Saudi Arabia, Qatar, Jordan, Oman, and Bahrain.

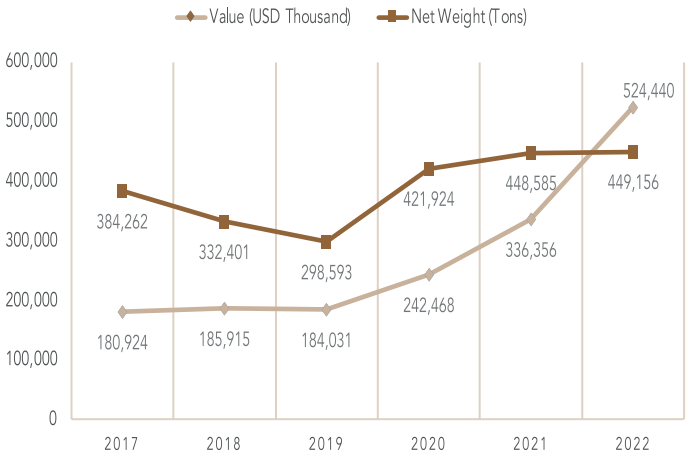


Figure 10: Values and Weights of Vegetable Products Exports, Source: Lebanese Customs- Vegetable Products General Exports, 2022.

- Processed food products: The data suggests that the value of processed food product exports from Lebanon experienced some fluctuations, with a recent slight increase. However, the net weight of these exports has consistently declined over the specified years, indicating a decrease in the quantity of processed food products being exported from Lebanon.

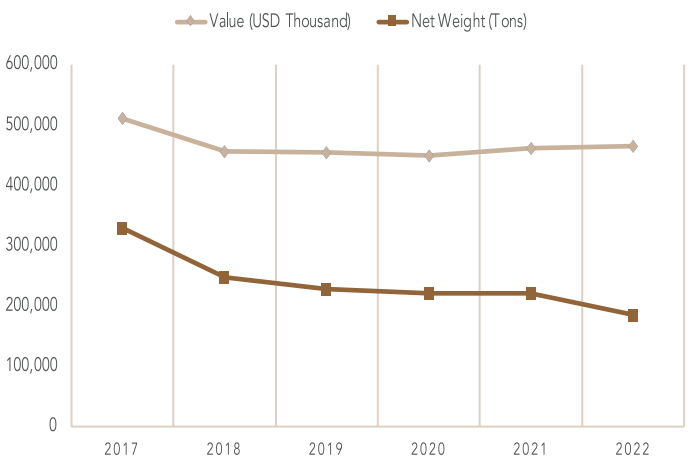


Figure 11: Values and Weights of Processed Food Product Exports, Source: Lebanese Customs, 2022.

The main importing countries for Lebanese agri-food products are composed of equal parts EU, North American, and Gulf countries, indicating a diverse set of destinations for these exports. Data shows fluctuations in the value and net weight of both wine and olive oil exports from Lebanon over the specified years. The average value per ton for both wine and olive oil exports provide an insight into the average market price for these products. Additionally, the diversity of importing countries offers potential for expansion and growth in this specific sector.

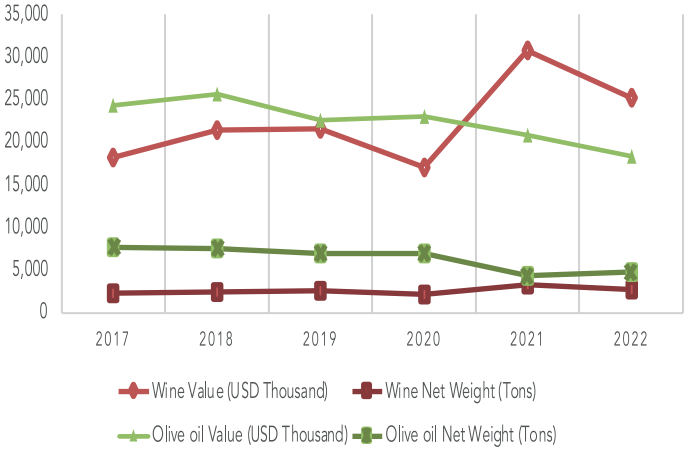


Figure 12: Export Revenue of Olive Oil and Wine, Source: Lebanese Customs, 2022.

c. Export Chains

What is meant by chains in this segment are the agricultural products that are sold to importers in a combination with other processed or raw outputs, in the form of a sales or marketing scheme. Upon conducting desk reviews, no such chains within the agricultural and agri-food product exports were found.

- Farming tools: Looking up re-exportations of the same items, none were found. Thus, it can be deduced that, indeed, Lebanon may actually manufacture and sell its own farming products. A peculiar thing to note is that these products are being exported to mostly African countries, most notably Togo, Sierra Leone, Liberia, Congo, and Angola, as well as Syria, showcasing the limitations of this product in terms of international reach and perhaps even hinting at the quality of these tools.

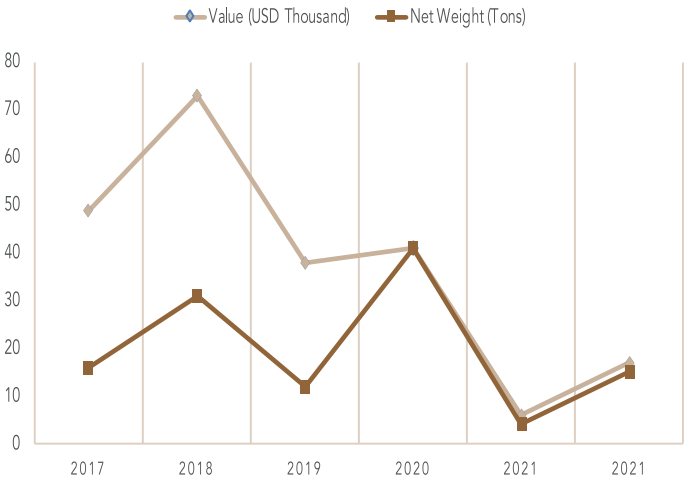


Figure 13: Farming Tools Exports Values and Weights, Source: Lebanese Customs, General Exports of Hand tools (shovels, mattocks, hoes, spades, etc....), 2022.

- Seeds: Lebanon does not create its own seeds in mass production. Thus, it does not possess the ability to export seeds of its own to the world. It could re-export imported seeds; however, with no figures to portray the imports of these inputs, the study cannot access nor showcase the fluctuations in seed re-exports.
- Fertilizers: In a much similar fashion to the farming tools mentioned above, desk reviews exposed that Lebanon does not possess fertilizer manufacturing facilities and companies for local and international markets. However, based on numbers acquired from the Lebanese Customs website, Lebanon has been earning surprising amounts of revenues through fertilizers exports; thus, leading to the reinstatement of the severe lack of proper documentation of information in Lebanon.

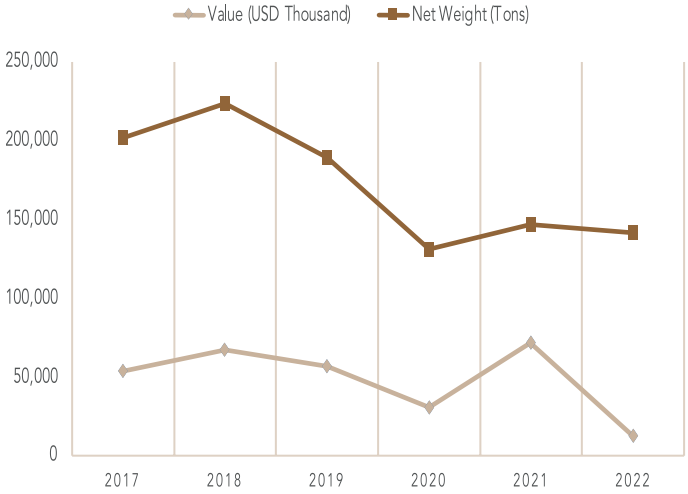


Figure 14: Fertilizers Exports Values and Weight. Source: Lebanese Customs- Fertilizers General Exports, 2022.

In the course of the last few years, the amount and value of fertilizer exports have experienced many fluctuations, in which the peak value for a singular ton of product was in 2018, 301 USD per ton. 2020 registered the lowest value of a ton of product, according to the author's calculation, is 231 USD per ton.

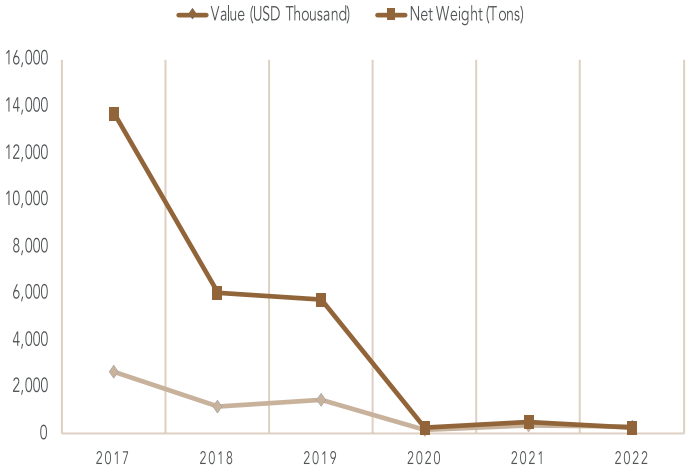


Figure 15: Fertilizers Re-exports. Source: Lebanese Customs- Fertilizers Re-exports, 2022.

The main importers of these products between the years of 2017 and 2019 have been Bangladesh, Argentina, Iraq, France, Turkey, and Greece. Whereas in 2020, the USA was the major importer of this product. However, some of these exports are re-exports of previously imported products, and they have been documented in the figure below:

The value of fertilizers re-exports fluctuated over the years, with the highest value recorded in 2017 at USD 2,635 thousand and the lowest value in 2020 at USD 155 thousand. There has been a significant increase in the average value per ton of re-exported fertilizer in 2020, reaching USD 635, which represents an almost 300% increase since 2017. This observation aligns with the data, as the value of fertilizers re-exports in 2020 was considerably lower than in previous years. However, data also highlights the lack of clear labeling and tracking of products along the entire value chain and trade process. This lack of transparency poses challenges for stakeholders in the sector, hindering their ability to fully understand and analyze the fertilizer trade and access detailed knowledge about the factors contributing to fluctuations in value.

- Pesticides: No desk research has enabled the authors to determine whether any agricultural input company manufactures its own pesticides in Lebanon. Furthermore, just as in the case of pesticide imports, neither the Lebanese Customs website nor the ITC Trade Map platform portrayed statistics pertaining to pesticide exportation.

5. Lebanon's Food Security

A nation unable to provide its citizens with their basic nutritional needs is an unstable and unsuccessful one, highlighting its own inability to both formulate and implement its food security plan. In Lebanon, the notion of food security falls under the responsibility of the Ministries of Agriculture, Economy and Trade, Industry, Social Affairs, Environment, Energy & Water, and Public Health, as described in the NAS 2020-2025 (MOA, 2020). The below segments showcase the most important aspects that should constitute any national food security plan.

a. Essential Plants for Food Security

With the absence of specific data portraying national food consumption per capita and food type, no alternative and indirect information source can be established either. Therefore, if any particular plants are to be listed as a national necessity for food security in this study, they will be chosen based on general assumptions made about local consumption patterns observed in personal, day-to-day lives, and cultural patterns as well.

b. Quality Assurance

Though the MOA bans certain inputs to ensure that the harvested fruits and vegetables are safe for Lebanese consumers, it has not set a specific quality protocol for individual products. On the other

hand, LIBNOR is the only governmental organization that supervises and monitors the quality of food products. However, they do not set specific quality standards for raw agriculture products either. Thus, though processed foods are being manufactured following specific protocols and standards for national consumers' safety, the raw agricultural vegetables and fruits are not.

c. Quantity Ranges

Establishing the type of necessary products alone is insufficient when attempting to formulate a food security plan for any number of people. A specific range of quantities must also be determined in order to ensure that, even in the worst-case scenario, every citizen will have access to enough quantities of specific products. As similarly determined in the sections above, there are no decided and accessible figures portraying the desired quantity ranges of products to ensure food security in Lebanon.

d. National Food Security Governance

Inquiring into food security is a national concern since all and any plans must fall under the supervision and control of governmental bodies. As established in the introduction of this section, these institutions are, in fact, ministries, entailing the Ministries of Agriculture, Economy and Trade, Industry, Social Affairs, Environment, Energy & Water, and Public Health. Though numerous committees for food safety, as well as its resulting jurisdictions, have been established, no singular committee encompassing all of these aforementioned governmental bodies has been created as of yet, according to extensive desk reviews.

e. Emergency plans and funds

The only official governmental document mentioning and planning for food security is the MOA's National Agriculture Strategy (NAS) 2020-2025. In the NAS, the third program under the first pillar explicitly mentions interventions to be made in order to ensure food security. This program increases the Lebanese agricultural sector's ability to meet local consumption demands.

f. National Import plan

Because Lebanon is unable to fully fulfill local consumption through local production, import plans, contacts, and cash must be set aside to ensure food security. Because Lebanon primarily imports more fruits and vegetables from Syria, Egypt, and EU nations, it is reasonable to presume that any contacts for emergency or general import plans are located within these specified countries. Furthermore, as showcased in the section above, the Ministry of Economy and Trade has been contacting two funding bodies from the international community as an emergency food security intervention measure, increasing the number of potential contacts for food security plans as well. Nevertheless, based on the information outlined in the sections above, no singular and accessible document/source exists detailing a full step-by-step food security plan, including all of the necessary contacts and figures.

6. Industries & Lebanon's Agricultural Sector

This segment attempts to detail the important industries (and the subsequent companies within each one) playing key roles along the value chain of agricultural and agri-food products. However, due to Lebanon's lack of clear and easily accessible information, no single official website or platform exists encompassing all of the desired names of companies within the below industries. Instead, an application called "Agvisor", established by the Chamber of Commerce, Agriculture, and Industry in Zahle and Bekaa and containing a directory filled with limited company names, will be used as a reference in the following segments of this section.

a. Agricultural Machinery

Machines are integral to the practice of agriculture. According to the 2010 MOA agricultural census, 109,509 out of 169,512 land operators use basic machinery, such as tractors, of which 88% rent them and 12% own them (MOA & FAO, 2010). With more than half of the holding operators utilizing essential machines, the existence of contact people and companies either selling or renting machines becomes mandatory for the assistance of farmers. This segment targets companies that provide agricultural machinery and tools that are not very technologically advanced or dependent. Providers of this type of machinery are most of the time companies supplying a variety of agricultural inputs. Of these companies, the application "Agvisor" noted 20, dispersed all over Lebanon.

b. Agricultural Technology

What is meant by "technology" in this paper is technologically advanced agricultural equipment like temperature and humidity controllers and nano-bubble-enriched water systems. The most technologically advanced equipment that are currently being provided and used in Lebanon are hydroponic systems, and even these are still extremely rare. These systems could be found in organizations promoting innovation, such as Berytech, or in companies like Daccache Agriculture and Hydroponica, that are designing and selling their own hydroponic systems nationally.

c. Input suppliers

Though machinery and technology are also considered as inputs, this section focuses on the agricultural companies that provide seeds, fertilizers, and pesticides for farmers. As with the other sections, there is no singular, nationally certified and completely inclusive platform containing all of the required data. However, a total of 126 records were found on the "Agvisor" application directory; yet, this remains an incomplete number. However, below, a few of the prominent agricultural input providers in Lebanon are enumerated:

- UNIFERT: A leading supplier of fertilizers, seeds, and other agricultural inputs, UNIFERT supports farmers in enhancing their crop productivity.

- ROBINSON AGRI: This company specializes in advanced agricultural solutions and supplies an array of essential farming inputs, helping to improve agricultural efficiency.
- ANTAGRO: Known for their high-quality seeds, fertilizers, and pesticides, ANTAGRO contributes to improving crop yields and farming practices.
- AMC: offers a comprehensive range of farming inputs, with a strong commitment to sustainable agricultural practices.
- COMPTOIRE AGRICOLE: A respected provider of seeds, fertilizers, and pesticides, COMPTOIRE AGRICOLE supports the agricultural community with reliable and effective products.
- DEBBANE AGRI: is dedicated to supplying farmers with a wide array of agricultural inputs, aiming to promote sustainability and productivity in the sector.

d. Transportation logistics

Agricultural lands are mostly distributed in rural areas, and resulting agricultural products are sold in either wholesale markets or retail markets, which are usually a distance away from the plots of land. Many of the products are also meant for international export and most of these get exported to ports or airports in cities. Therefore, several modes of transportation are required to ensure the shipment of these agricultural products. The following section outlines 12 international shipping companies and local transportation companies. However, there were no specifications available to determine how frequently they conduct check-ups on the sanitation and maintenance of cargo containers.

Company	modes of shipping		
	Sea	Land	Air
Air France			x
Al Amin Transport SARL	x	x	x
ALL ZONES ALL DESTINATIONS,AZAD CO.	x	x	x
Antarsped Forwarding Services-Adel Chebli & Co. Sal	x	x	x
Aramex Lebanon SAL	x	x	x
Beirut Cargo Center BCC Logistics	x	x	x
CMA CGM	x	x	
DHL Global Forwarding	x	x	x
Embassy Freight Lebanon	x	x	x
Expeditors International Lebanon	x	x	x
Gezairi Transport SAL	x	x	x
GIFCO	x	x	x
Grabit SARL		x	
Middle East Airports Services MEAS Sal	x	x	x
Saad Transport	x	x	x

Table 5: Shipping and Transportation Companies

e. Agri-Food Processing Facilities

By November 2019, there were a total of 1,543 licensed industrial facilities and enterprises concerned with the agri-food sector (Ministry of Industry Industrial Guide). However, no directory showcases the number of unregistered companies or industries. According to the IDAL, Agri-Food Sector Incentives report, agri-food practices and plantations for supply were mostly centered in Mount Lebanon, with a concentration of 48% in 2018. Bekaa had the highest concentration of agri-food industry 18%, followed by North Lebanon 9%, Baalbeck El Hermel 6%, Beirut 5%, and Akkar 2% (IDAL, 2020).

f. Storage facilities

Many farmers and companies require storage facilities to safely keep agricultural produce. Though it is claimed that each region contains 20 cold storage facilities, the authors of this study were only able to acquire the names of seven, along with the name of one pre-cooling room. With the chronic and long-lasting fuel crises of 2021, acquiring the necessary fuel to provide electricity for these storage rooms was a difficult feat. Finally, similar to the case of transportation vehicles, no specifications pertaining to the presence and frequency of sanitation and maintenance auditing were available while conducting desk research on storage facilities in Lebanon.

Name of Facility	Number of Rooms	Room Volume m3	Room Capacity (tons)
Ali Hamad	5	Not specified	Not specified
Antoun El Murr	11	1,300 m3	1,200 Tons
Arcenciel-Deir Taanayel	8	1,000 m3	1,600 Tons
Kendirjian Institution	1	63 m3	120 Tons
Melhem Merhi & Partners company			
for Packing and Cooling	6	1,300 m3	1500 Tons
Mounzer Cold Storage provider	5	550 m3	750 Tons
Nahas Company	9	1,200 m3	100 Tons
Raynchouni Cold Storage	2	Not specified	16,000 Tons

Table 6: Distribution and Characteristics of Cold Storage Facilities, Source: Agvisor, 2022

7. Lebanon's Agricultural market dynamics

a. Local market

The primary market for any farmer desiring to sell his products is the national one. In Lebanon, national markets are divided into two general categories: wholesale markets and retail markets. In the case of wholesale, there are eight main and big wholesale markets in Lebanon placed in the regions of Akkar, Beirut, Ferzol, Byblos, Kab Elias, Saida, Sin el Fil, and Tripoli. Due to the poor regulations of the wholesale markets, many farmers have, instead, opted to sell directly to retail markets. These markets range from small grocery stores to big supermarket franchises. When selling directly to these stores, farmers are guaranteed 100% of the revenue generated from selling their products and are able to control the pricing of their products a bit more freely.

b. International markets

With the bilateral free trade agreements and GAFTA detailed in the trade section of this study, as well as the proximity of neighboring Arab countries, Lebanon sends much of its produce to the UAE, Syria, Jordan, Kuwait, Qatar, Egypt, and Oman. Saudi Arabia and Bahrain used to be big markets for Lebanese agricultural product exports. However, due to political conflicts, both of these countries have cut off their imports from Lebanon as of August 2021. Other than the Arab world, European and North American countries, such as the Netherlands, the United Kingdom, Sweden, France, the United States, and Canada constitute another significant international market for Lebanese produce. However, unlike in Arab countries, the quantities of products being exported aforementioned destinations are much lower, due to higher competition within these markets. The below tables draw a comparison between the prices of Lebanese table grapes and wine both locally and abroad as a small example of the type of information that should be easily accessed by farmers.

	Wine	Type	Year of production	Price (USD)	Size (CL)	Exclude Tax (USD)
Lebanon	Cuvée du Pape	Chardonnay	2018	4.4	75	3.92
	Reserve du Couvent	Red wine	2019	3.0	75	2.67
United Kingdom	Reserve du Couvent	Red wine	2019	26.317	75	21.89
	Cuvée du Pape	Chardonnay	2018	41.309	75	34.427

Table 7: Price Comparison Between Lebanese Wine Prices in Lebanon and in the United Kingdom. Source: Chateau Ksara (Château Ksara, 2022) & Wine Direct Websites (Wine direct)

	Type of table grapes	Price (USD)	Unit (kg)	Exclude Taxes (USD)
Lebanon	Red Grapes	3.1	1	2.76
Kuwait	Red grapes	5.55	1	5.27

Table 8: Price Comparison Between Lebanese Grapes in Lebanon and in Kuwait. Source: Spinneys (Spinneys Lebanon) & (Taw9eel) Website, 2022Source: Agvisor, 2022

Chapter II

Stakeholders' Insights

II

Stakeholders Insights

The findings and insights of the conducted key informant interviews are meticulously presented in a detailed and structured manner. The "Capacity Overview," section puts forth a three-fold analysis. First, a self-assessment by farmers on their educational level, technical knowledge, and access to expert consultation. This self-assessment is subsequently compared with experts' assessment of the farmers to unveil whether disparities exist between perceived and actual competencies within the agricultural sector. The section then transitions to the valuable insights from government representatives, focusing on crucial themes such as data collection, access to education, and market study responsiveness. These insights illuminate the administrative and structural strengths and weaknesses inherent in the system, thus setting the stage for potential interventions.

Further, the second section of the chapter titled "Bridging Practice and Potential" presents an in-depth understanding of the challenges faced by farmers, exploring farming methods, quality control, safety measures, labor dynamics, and their existing needs. This segment also critically examines the experts' recommended farming practices, thereby facilitating a rich comparative analysis that can aid in identifying areas of improvement and optimization. The last part depicts the role of government support. It meticulously details the ongoing development projects, food security policies, quality control measures, and suggested agriculture policy reforms. Each aspect serves as a testament to the government's initiatives and also highlights areas needing immediate attention.

This chapter is a testament to the stakeholders' resilience and commitment, their challenges, and the systemic gaps within Lebanon's agricultural sector. Through an informed and detailed presentation of stakeholder perspectives, it paves the way for collaborative efforts aimed at fostering a sustainable, efficient, and resilient agricultural system.

A. Capacity Overview

This section provides a comprehensive overview of farmers' capacities, examining their self-assessment, expert evaluation, and government insights. Farmers' self-capacity assessment reveals their educational level, technical knowledge, and access to expert consultation. Expert evaluations offer additional perspectives on farmers' educational level, technical knowledge, and access to expert consultation. Government representatives provide valuable insights on data collection, access to education, and market study responsiveness. This multifaceted analysis highlights the strengths, weaknesses, and potential areas for improvement within farmers' capacities in these key dimensions.

1. Farmers' Self-capacity Assessment

a. Educational Level

The presence, or absence, of formal education, is an important factor to consider when acquiring the necessary agricultural awareness. Upon interviewing four selected farmers, the acquisition of formal education was barely tackled, as exemplified by the statement of Toni Elia, a strawberry farmer from Safra, "I'm a 78-year-old man and I started farming when I was 12 years old. I'm uneducated and used to helping my dad in the fields". Mr. Elia is just one example of the numerous farmers that have either received very minimal or no form of education, with 61% of farmers previously stated in the literature review to have received very primary and basic education while 16% remained illiterate (Bahn, et al., 2019). This general lack of formal or advanced education integrated itself with many of the farmers' beliefs, pushing them to primarily value the technical skills needed in agriculture over any form of education. Vera Sakr, a tomato farmer from Batroun, portrays how farmers perceived essential type of knowledge is limited to basic farming practices; she states, "The farmer should at least have the basis to know how to plant a tree, how to construct a tent, and how to water the plants. He should be at least a bit experienced in plants so he could tell me what the plant needs, he cannot have zero knowledge." Finally, another issue to be highlighted is farmers' insistence on the pursuit of technical skills over formal education. In such cases, farmers become attached to traditional knowledge acquisition methods, meaning hands-on practice. This renders the oldest farmers the wisest, as seen with Vera Sakr who said, "Farming isn't meant for everyone. Old farmers have more experience in agriculture. Workers with no experience have no chance in continuity." Thus, agriculture no longer becomes something that farmers prefer to be taught in schools or educational institutions. To many Lebanese farmers, agriculture is seen as a skill that can primarily be taught in the field, and, with the numerous types of plantations possible, every farmer becomes a master of his or her own knowledge, as Abdel Hamid Khasroum, a strawberry farmer from Safra as well, stated "Every farmer to his knowledge!".

b. Technical Knowledge

After negating the necessity of formal education in the agricultural sector, the interviewed farmers were then asked to list in the most

minute details their process in their planting cycle, from start to finish, including the budget required for each step. It was observed that, though all four interviewed farmers extensively explained the farming procedures that went into play from soil preparation to harvest, they were unable to provide specific numbers pertaining to the time required for every action. Indeed, the farmers found it easy to share details on their crop cycle; Youssef Lahoud, an avocado farmer from Chouf, went as far as sharing his calculations regarding how many seeds to plant in different sections of his, "The bag contains around 50g of seeds and it covers four areas of one m 60 each." However, when it came to detailing individual expenses, quantities of products used, and the time necessary for taking specific actions along the crop cycle, it was noted that many of these farmers were unable to provide specific numbers. "I don't have exact numbers" is a notion agreed upon by Vera Sakr. Toni Elia on the other hand, went as far as discussing the instability and unpredictability of the planting cycle, "I can't say. I mean, it's not that I can't tell you but it's because it's like playing your hand at poker. Having a field of strawberries is unpredictable. If you plant 100 000 plants of strawberries but the season wasn't great and they died. So, like a game of poker, if a pile of cash was in front of you, they could all go by playing just one hand. If it goes then it goes. Strawberries and not only that, the whole field of agriculture is volatile and you can't make a stable business out of it." Furthermore, some older farmers, leaning more heavily on the traditional side, have shown not to even track expenses at all. Youssef Lahoud's father was one such example of this phenomenon. Indeed, Youssef said "I have data and information for 2021, because I am now handling all the financial stats. It is an inherited land and my father was not interested in business enough to put a good plan and archive stats." This brings rise to a theme that will continue to prevail in the following segments. It is the opposition between traditional farming, one that does not require formal education or combine business with farming, and newer scientific and business approaches to farming.

c. Access to Expert Consultation

This section covers farmer's frequency of consulting experts or other fellow farmers with more expertise on a specific type of product or approach, as well as the farmers' readiness to accept experts' assistance instead of relying on the concept of "Every farmer to his knowledge!", as Mr. Abdel Hamid stated. This aspect of self-capacity assessment, much like the assessment of technical skills detailed in the section above, could only be assessed using qualitative data collection practices. Thus, no official statistics were found discussing this matter in the literature review. Nevertheless, upon interviewing the four farmers, a clearer idea was formed on these individual farmers' opinions and experiences with experts. Half of the interviewed farmers reported to be working with experts from an input providing company. Mr. Abdel Hamid shared, "I work with "Debbane", I also work with other companies like "Amalia"." who "do experiments on my land and water". These experiments aided Mr. Abdel Hamid in optimizing his crops. Mr. Elia, however, a bit different, only admitted to acquiring agricultural inputs from the same company, "Debbane helped by getting me the plastic covers for the whole pond with 1000 [micron] that last 15 years". These two farmers portrayed positive experiences with the input-providing company. However, just as mentioned in the section above, some farmers preferred to rely on themselves and avoid seeking expert assistance. Ms. Sakr mentioned that "Old farmers have more experience in agriculture.", which reinforces the notion of farmers preferring traditional modes of knowledge acquisition further exemplified and sustained by Mr. Lahoud's statements of "We teach ourselves, from our knowledge." and "it is inherited knowledge. It is trial and error." When asked if they would consider joining a cooperative, Mr. Lahoud claimed, "No, it doesn't make any sense, they are not helping the farmers and not giving them any guidance or benefit. But surely, I would love to be part of them if they started playing their role." Hence a pattern arises of thought observed in multiple interviewees. This pattern of thought is based on the allocation of responsibility and blame to other stakeholders within the sector. In the case of Mr. Lahoud, responsible cooperatives were held accountable for not playing their role. Whereas, in the case of Mr. Abdel Hamid, responsibility and blame were placed on the shoulders of the Ministry of Agriculture for not carrying out their duty as field experts and assisting and teaching the farmers, "I'll tell you it frankly, nobody from the ministry of agriculture is coming to us". Therefore, it can be noted that the farmers that have consulted private sector experts for assistance have reported having positive experiences with them, whereas the rest of the interviewed farmers have opted not to consult anyone and rely on their own knowledge. Finally, both farmers that have consulted experts and those that haven't, shared their dissatisfaction with other stakeholders in the sector that should be providing expert assistance, in this case, cooperatives and the Ministry of agriculture.

2. Experts' Assessment of Farmers' Capacity

a. Educational Level

When interviewing experts on the observed level of education within farmers, a stark contrast was observed between the opinions of these experts and farmers on the topic. The majority of the interviewed experts expressed a need for increasing farmers' levels of education. Rana Abdou, program manager at Arc En Ciel Taanayel claims, "we are targeting young people to integrate them in the agriculture sector, because they are more educated, critical thinkers, and flexible". Her opinion is backed up by Rafi Debbane, Chairman of Debbane Group, exposing a traditional trend in agricultural employment: "Kids will grow up and make their own income, so the father would choose the child that is not that bright to carry on in agriculture." This statement highlights an issue in the cultural beliefs tied to employment in agriculture, one in which the least educated within a family would enter the field for no better employment opportunities. Recurring instances as such create and fortify an assumption that agriculture is not a career in need of formal education, and that the most basic of skills are needed to start a path in agriculture, as many farmers stated in the segment before. However, cultural beliefs and trends were not the only issues highlighted in the interview with experts. Rafi Dabbane also exposed

a fault in the educational system targeted toward agriculture, "Students are graduating without any experience." Thus, even when receiving formal education from Lebanon's technical schools on the subject of agriculture, according to Debbane, it is still insufficient to provide the future farmer with a comprehensive approach to this career path. In complete opposition to these recorded opinions, one interviewed expert mirrored the farmers' beliefs on education in agriculture. Soha Frem, entrepreneur and CEO of Wata Cider, noted "Skill is more important than education. Nowadays, we see lots of highly skilled engineers up to date with the new programs, but, when it comes to Lebanese workers, they lack the competency needed in the agriculture process. We are even noticing that we are losing the inheritance of skills from father to son, and it is a big issue." In this statement, Mrs. Frem highlights the importance of traditionally acquired agricultural skills: the inheritance of these skills from farming fathers. Thus, based upon the interview answers, receiving formal education prior to pursuing agriculture is something recommended by many experts within the field, yet the subject remains debated even amongst these experts.

b. Technical Knowledge

As shown in the literature review, many aspects of the field hold missing information. The interviews with the experts in the field were conducted for the purpose of attempting to fill in these blanks as well as drawing a comparison with the knowledge that the farmers possess. The findings extracted can be divided into two emerging themes: the still missing data and the acquired information and estimations. When attempting to find any updated values on the 2010 agricultural census, especially ones pertaining to the currently utilized agricultural lands and those left abandoned, the interviewed experts were unable to provide the research team with national-scale numbers beyond those published by the MOA in 2010. Henry Helou, a PhD. holder in Lebanese flora and fauna, stated, "We also don't have data on how many lands are being used for agriculture", backed up by Roy Ayek, an agricultural engineer in Debbane Agri who mentioned private sector attempts at mapping, "We do something close to it but there is no one doing statistics on what's being planted." However, such mapping only takes into account the farms' partnering with this input providing company "We do have some maps, especially big farmers whom we deal with". With so limited data available to the experts as well, many had to resort to estimates or simply not providing answers when asked statistic-specific questions. That was the case with both Henry Helou and Roy Ayek who mentioned, respectively, "I don't know the statistics and I don't want to say anything that I'm not sure about." and "I don't have the numbers in front of me but I can give you an estimate. "The inability to provide the research team with specific data had other causes as well, one of which was due to the instability of product prices due to the economic crisis, and another was due to private companies' inability to share detailed information pertaining to specific expenses or budgets. Soha Frem explained both cases by stating that "We can't rely on last year's prices because the market was unstable" and that "We usually do not share internal information, what I can share is the costs of pesticides". However, though specific and up-to-date statistics were not begotten from the interviews, much interesting and enlightening information was extracted. Rana Abdou was able to provide the research team with an example of a seed-creating lab in Lebanon, contrary to what the desk review showcased and what other experts assumed. She said "The ICARDA is working on seeds of grains and peanuts... They have a seed bank. But there is not a sophisticated lab for creating seeds, it is complicated having such a lab. The ministry was putting a plan for a lab but it is difficult. Technically it is complicated, because most of the time it is a cross-breeding between plants, to make them purebred." Furthermore, Naim Khalil, the chairman of the Union of Lebanese Exporters and Importers of Fruits and Vegetables, was able to share rough estimates on local consumption habits, deduced from calculating local production as well as imports. He claims "As for Lebanon's consumption, at least 400,000 to 500,000 tons of potato per year, 500 to 600 tons per week, and 20,000 per month." and that "Lebanon consumes around 120,000/130,000 tons of potatoes. And the other varieties of vegetables are around 30,000/40,000 tons." These numbers, though estimates, portray a general idea on what quantity of a singular product is needed to be produced in order to achieve self-sufficiency on a national scale. Finally, Mr. Khalil was also able to share the general cost of refrigerating a basket of products, yet the example cost was that of 2021 and related to apples only. Thus, the value may no longer be applicable to the specified fruit, as it does not apply to other types of products "I'll give it to you exactly how it is, a basket of apples will cost USD 2.5 up until the new year or 15 days after". Thus, though not statistically intricate, each expert provided additional information from their own field of expertise to fill in some of the vast data gaps left open by public sector stakeholders.

c. Access to Expert Consultation

The experts were asked whether they present their extensive knowledge to farmers as well as what they would implore farmers to know and watch out for. Given that some of these experts work in companies or unions that let them directly interact with various farmers, the overall response to whether these experts' knowledge is being transmitted to the proper target audience was positive. Some experts discussed their own methods applied to directly help develop the farmers. Rana Abdou shared Arc En Ciel's plan to help the farmer sell more through marketing strategies, "We are trying to fix this problem by marketing, we help this farmer by telling him what to plant and we buy his products, and that's what we are doing at "Beit El Mouzerih". It is the only way to help him". Additionally, Ray Ayek described the process behind the consultation services provided by the input company, Debbane Agri, "The Farmer comes to us and then we give them advice on what to do in his land. For example, he tells the research team how many tomatoes he has if he has 2000 square meters of land. We tell him how much to spray around". In a different manner, some experts chose to share information and advice for the farmer through the interview. Mr. Debbane discussed the existence of the chambers of commerce, previously mentioned in the literature review, and referred to them as means of providing farmers with consultation "Any farmer that wants to

choose what to plant can go to these rooms and get consultation". This statement can be translated into a call for farmers to go out and seek knowledge and development from experts on their own, opposite of the approach described by Rana Abdou, where some companies or organizations go to the farmer to offer assistance. In both cases, multiple experts reported an ongoing issue of farmers' lack of readiness to receive their assistance. Roy Ayek says "Some farmers are truly hostile and think that you're here just to sell them more products", highlighting the aversion that farmers hold toward experts from private agricultural input companies due to their fear of being scammed into buying products that may harm their crops. Rana Abdou provides a different perspective on the same issue faced by farmers. She states that "we should change the mentality of the farmer, he should adapt and develop, we are working on it. The farmer in Lebanon is very strong-headed", and follows it with a personal example "It is easier for the farmer to plant only one kind of plant or product. I am facing that problem. My father is a farmer and he only wants to plant melons on all his land and I can't change his opinion about planting many types of plants." This example tackles a common trait within farmers, as opposed to Roy's description of their fears. Both examples, however, resonate with the interviewed farmers' opinions on receiving professional assistance and instructions while also portraying how both parties in this case are allocating blame to the other for lack of responsiveness. As such, the theme of blame allocation and opposition recurs again.

3. Government Representatives' Insights

This section provides insights from key public figures, two representatives from the Ministry of Agriculture, that either prove or disprove opinions begotten from the other stakeholders in this section and fill in data gaps when possible. However, before commencing this section, it is important to note that the representatives of the MOA requested to remain anonymous and that the meeting remain unrecorded. Nevertheless, all information provided in this section was noted in depth.

a. Data Collection

As observed from the literature review and the interviews, finding accurate and up-to-date data on agriculture, lands, and people was difficult. Thus, multiple questions were raised to the ministry members to fill in the information blanks where needed the most. Responses were numeral, yet remained inconclusive. When asked for more updated statistics than those presented in the 2010 census, the MOA representatives introduced the 2021 census. They also explained that the comprehensive census was to be conducted once every ten-years. Thus, upon request, a copy of census was received and checked. The most important findings to be taken from the 2021 version of the census pertained to the total production quantity of particular agricultural products in Lebanon as well as the estimated total selling price of each within the nation. No information regarding abandoned lands, current lands, technologically equipped holdings, types of agriculture in each plot, or laborers was present in the 2021 census. When tackling the subject of laborers specifically, the MOA members were advised to consult CAS, which, as displayed in the literature review, proved to have no updated information regarding the labor force in agriculture, including the nationality of laborers. Furthermore, when inquired on their method for acquiring the data required for the census, the MOA representatives explained that they send field officers to conduct the data collection, taking representative samples and numbers from annual surveys. This information sheds new light on the census itself, rendering its full credibility questionable, as utilizing representative samples does not imply that a full, extensive, and accurate data collection was done. The credibility of information provided by the MOA was further questioned when questioning the presence of any data regarding food consumption of particular agricultural products in Lebanon, as well as food waste percentages. Similarly, to some experts detailed above, the MOA representatives provided the research team with rough estimates on the waste of tomatoes that were calculated or evaluated on the spot, stating that almost 25% of tomatoes are wasted in the summer alone due to pests and diseases. Therefore, many of the interviews with the MOA representatives mirror those conducted with private sector experts in the sense that it provided new insight in certain areas but could not update or complete data derived from the 2010 census.

b. Access to Education

The Ministry of Agriculture in Lebanon provided valuable insights on the topic of education in the agricultural sector. They confirmed the existence of seven technical schools for agriculture in the country, with the exception of one located in Fanar, all of which were situated adjacent to agricultural plots. This proximity allowed students to receive hands-on training in the field, contradicting claims from private sector experts that graduates lacked the necessary technical experience for agriculture.

It should be noted that the Ministry of Agriculture does not directly intervene in the curricula of university programs teaching agricultural engineering. However, the representatives from the ministry stated that the technical school curricula were last updated between 2016 and 2017, making them relatively recent, considering they correspond to the most recent and verified global findings. Therefore, any changes or updates in the curricula would need to align with current knowledge and practices. These revelations serve to refute criticisms directed at the public sector regarding

formal agricultural education in Lebanon's technical schools. Any shortcomings in university curricula would require involvement and collaboration from other stakeholders, both private and public, within the agricultural field.

Balancing Market Needs: Adaptive ApproachesAn essential part of the Ministry of Agriculture and other governmental bodies' responsibilities in this field are the constant study of current market needs and phenomena, as well as these bodies' responsiveness to these discovered needs and happenings. An example of measures taken to tackle awareness needs among farmers, the MOA representatives elaborated on multiple programs implemented to teach farmers, on pilot plots, how to use pesticides and fertilizers on products to ensure food safety as well as quality. These programs were reported to run from 2015, but were discontinued due to the circumstances of recent years. However, no exact numbers were provided on the frequency of the training sessions and the total number of farmers targeted. Thus, though the existence of the programs does tackle a need frequently depressed by farmers and experts alike on the proper use of pesticides, with no specific numbers showcasing their effectiveness, the agricultural market can be assumed to remain in need of such awareness. In an additional example of responsiveness to market needs, the MOA representatives discussed the market's demand on tomato products this year due to unstable and excessively harmful weather conditions to the plant itself. The members of the ministry explained that, upon knowing of the failure of the crops, additional efforts were made to import much of the tomatoes needed for local consumption from Syria, an action that can supply local demand much quicker than importation from any destination. However, it was not specified whether these actions were taken as preventive measures upon studying local productions prior to the failure in meeting demands. This lack of information may potentially support farmers' and private sector experts' claims on the ministry' underperformance of its responsibilities, especially those pertaining to regular monitoring. Finally, intertwined with the need to constantly update relevant data in the field, the Ministry of Agriculture is responsible for being aware of what is planted in Lebanon, as well as what are the optimal products that can be planted in each agricultural area. While extracting data from the 2010 census, no information was available on potential and very beneficial plots of land on the Lebanese map, nor was the information related to the best products to be planted in each district or area as substitute or extension to local production available. When questioning the MOA representatives on the matter, they repeated information already provided in the census but did not elaborate on untapped potentials. They also explained why diving into the plantation of very new products would be too costly and inefficient given current circumstances. Thus, though instances disproving popular assumptions made about the ministry's lack of responsiveness were given, more information gaps arose during the interview that were left unfilled and raised more questions on the extent of the Ministry's reach as well as its effectiveness.

B. Bridging Practice and Potential

This segment showcases the various types of practices adopted by farmers in their profession. These practices will be compared to the preferred suggestions provided by private and public sector experts as well. The section will also display any information that completes or complements data gaps in the literature review, when possible, as well as bring to light more gaps , if any. Finally, all requirements needed by each stakeholder to optimize performance and production will be detailed as well.

1. Applied Farming Methods

a. Farming Practices

A particular trend of thought expressed by the interviewed farmers in the segment above is the preference for traditions, particularly traditional methods of gaining experience and knowledge. When asked about the particular actions taken in each part of the crop cycle as well as the type of equipment used, many were quick to express using some sort of relatively advanced methods or equipment. As opposed to relying on the traditional, open-field, water-wasteful practices, Vera Sakr, Abdel Hamid Al Khasroum, and Toni Elia plant their products under tents, which necessitate drip irrigation methods, "I use the drip irrigation system using the tubes." said Abdel Hamid Al Khashroum. Using the drip irrigation method, as opposed to the traditional irrigation through hoses, limits the water quantity used to what is precisely needed and recommended by experts for each product. This method contradicts Youssef Lahoud's quite traditional one of letting the stream of water close to his family's plot passes through the planted products "The water is always passing by our land so there is no cost for water". However, even Mr. Lahoud himself would much prefer a less wasteful and more updated method of irrigation, "I would like to use my big quantity of water through developed methods like drip method but it is so expensive, around USD 2,000 to 2,500." This statement brings to light the first and most significant barrier that farmers face when it comes to updating their practices to fit current times. Youssef Lahoud possesses very traditional equipment, as he claims "I only use traditional, manual equipment." Indeed, none of the farmers interviewed utilize any technology more advanced than drip irrigation, which can be deduced to be due to their overall inability to invest in such pursuits. Furthermore, when studying the nature of farmer's practices, emphasis was placed on the safety of these practices on the farmer's health. This is indirectly intertwined with the extent to which the equipment and methods used are up-to-date with global findings. As an example, Youssef Lahoud, after being asked about the safety measures taken while working in the field, was the only farmer to report being more at risk of safety hazards, "Nothing, each year someone in the family gets hurt." He follows this statement with "There are no experts to help the farmers or any plans made for the farmer on how to work." Which re-emerges the running theme of blame-allocation observed in the previous sections. Nevertheless, in a display of Lebanese farmer's ability and resilience to adapt to the hardships and the demands of current economic conditions, all of the interviewed farmers, in one way or another, described multiple actions taken to keep their businesses standing. All of the farmers reported planting more than one type of crop on their land to maximize space efficiency, "We use the tent space efficiently. We plant tomatoes in the middle and the other plants on the side," said Ms. Sakr. Youssef Lahoud described the measures he takes to minimize the costs of buying seeds by creating his own in the field, "It is very easy to create my seeds. For example, the small trees that we have were made by taking parts of the bigger trees we have." In another light, Vera Sakr, as well as Youssef Lahoud, resorted to the organic plantation, in which they both minimized the need for chemicals as much as possible, Ms Sakr added "I use very little amounts of chemicals". Finally, with the surging frequency of power cuts, most of the interviewed farmers resorted to buying their own generators, so as to not interrupt the irrigation cycle, "I have a generator which costs between USD 5,000 to 6,000," said Mr. Elia. Thus, though adopting a minimal number of updated and new technologies, the interviewed Lebanese farmers displayed outstanding adaptability skills when standing in face of the current economic crisis.

b. Quality Control and Safety Measures

Some practices that must be highlighted separately from others are the actions and measures taken to ensure the end product's quality and safety for consumption. As such, the four interviewed farmers were asked about the quality standards that they follow. Since the Ministry of Agriculture does not enforce any explicit quality standards or practices, as detailed in the literature review, what was inquired of the farmers mainly pertained to any pirate sector, or external standards or certifications that these farmers may hold. No interviewed farmer reported holding any quality certifications. However, each farmer, in his and her own way, described actions and research conducted to ensure that their products remain of great consumable quality. Vera Sakr said, "I am following the standards but I have not gotten the certificate yet. There are a lot of prohibited things that we do not use. And as you know, the organic field is very vast, and it is hard for you to follow it closely. I always taste my own products before introducing them to the market. I follow the standards set by the agricultural and health ministries." This statement portrays how she attempts to remain up-to-date on any required procedures or measures to ensure that her products remain organic and great for consumption. The action of measuring the quality of a product based on whether it can be consumed at home or not is something that Youssef Lahoud does as well. He stated that, "In general, there is no quality standard to guide the farmer, but I set my quality standards. All my products are of very good quality because the same products that I sell on the wholesale market are the same ones that my family and I eat from. I only send to the wholesale market and to the consumer the best quality. No one is guiding the farmer on what type of products to plant or to sell." Both of these farmers' statements and actions highlight how far some farmers may be from expert consultation as well as hint at underlying strong-headedness for self-reliance, as expressed by experts in the previous sections. When connected to the recurring, blame-allocating statement of farmers not receiving

any help, it can be implied that some farmers are not going out of their way to consult experts to seek assistance as well, whether for the practices necessary to ensure great quality and safe products or not. Furthermore, another display of farmers' resourcefulness and self-reliance when it comes to ensuring the quality of their products, Toni Elia utilized particularly creative methods to enhance the quality of his crops through rich irrigation. He said, "I also bought ducks [in the created pond] but it turns out they're not good for the crops and they also prefer the cold so I bought Tilapia fish instead from America. I bought 150 fish along with their food and now they're about 2000 fish in that pond. I also water the crops evenly so everything's going smoothly and the fruits are coming out great even without adding the pesticides." This comes as another example of farmers' resourcefulness and adaptability in their profession, even if it comes without much expert consultation. However, the example of these three farmers cannot be applied or generalized to all. Many farmers, such as Abdel Hamid al Khashroum, still rely on utilizing vitamins, fertilizers, and pesticides to ensure the quality of their products. He stated that, "Because of the weather this year, I'm spraying them once every week or ten days depending on the weather. Every temperature has its own disease. You have to pay close attention to them, and I use vitamins on my plants." These measures come as preventive care which is a great strategy to avoid future disasters. Nevertheless, even the example of Mr. Al Khasroum may not be very common. Some farmers may not be applying any measures to ensure the quality of their crops. No generalization or progress can be made if specific statistics on these farmers are not acquired.

c. Labor Dynamics and Needs

When it comes to manual labor, the larger the farming field, the more additional help is needed to complete all needed tasks from planting to harvesting. In Lebanon, there is no updated information detailing the exact number of people working within the agricultural sector, their specific positions (whether land owners, laborers, researchers, etc...), their gender, their age, and most, importantly their nationality. The issue of nationality is brought up in this segment in order to observe the extent of Lebanese laborer's participation in the agricultural sector, given the current unemployment and economic crises. Another assumed minority group in the agricultural sector whose participation is to be determined is that of women. The results yielded, however, cannot be taken as representative samples, as they are not nearly large enough to derive generalizations from them. Two farmers reported requiring the assistance of additional, foreign laborers in their fields. Youssef Lahoud claims that this assistance is merely temporary, dedicated to specific jobs, "We only hire labor for what is called seasonal jobs. We hire Syrian people who are called experts in this kind of job in our village." Vera Sakr, similarly to Youssef, employs laborers to help her with specific tasks when requested, "We are only getting regular help in our land, we tell him what to do and he does it, he doesn't initiate anything on his own." Many of these laborers used to be Egyptian and necessitated renewals of residential permits, "I had Egyptian workers where the government forced us to have them insured and apply for their residential card but right now everything is chaotic." Toni Elia also expressed his use of seasonal workers as well, "A tiller with his tractor comes on call and I pay for the rent of the tractor simultaneously." From these statements, one trend can be observed. First, is the Lebanese farmer's tendency to choose foreign laborers' assistance for seasonal jobs more than permanent ones. One reason can be attributed to the costs of providing the laborers with a sustainable income, as well as additional costs arising from necessary paperwork to be done by the farmer to maintain these laborers' presence within the Lebanese borders. Another reason may be due to the unstable workload of agriculture, where some day's extra labor and assistance may be necessary. In either case, the use of seasonal workers as expressed by the farmers backs up the 2010 findings showing that the number of seasonal workers (in the case of the census Lebanese family members of the farmer) overpowered the number of full-time workers (also Lebanese family members of the farmer). In terms of gender representation in the agricultural sector, it was only in the case of Vera Sakr and Abdel Hamid al Khashroum that women were observed to be working in this field. In Ms. Sakr's case, it is Ms. Sakr herself who represented women in agriculture, whereas in Mr. Al Khasroum's case it was his wife, "I have my wife who helps me and my son, and I also have a worker who helps me." However, when comparing these two examples of women in the field to the multiple other mentions of men (whether farmers or laborers) in the field, agriculture remains a largely male-dominated field, which backs up the statistics provided in the 2010 census, detailing that only 9% of agricultural holders are women. Finally, the interviews with the farmers proved multiple statistics provided by the 2010 census are still valid now, even if they didn't bring to light any specific and updated numbers.

d. Addressing Farmers' Needs

In order to improve the current standing of the agricultural sector, one must look to improve the farmers' working conditions first. Thus, the four interviewed farmers were asked what they particularly need to enhance their production and working conditions. In an almost unanimous manner, the most common constraint to the farmers' work is financing. The crisis and all of its consequences were running conversation topics in the conducted interviews. "I just need support to continue my work. I have many problems that start from the workers to the fuel to maintenance. I just need support to improve and continue", claims Mr. Al Khashroum, bringing to light how the economic crisis has impacted and hindered the smooth progression of many actions taken in a singular crop cycle, from employing the necessary labor to plant and harvest, to the energy and neutral resources needed for irrigation and maintenance. This is further exemplified by Mr. Elia's statements, "In this current economic crisis, who will look at us or try to lend a hand? If we need money, who will help out? We don't even have electricity for the generators and pumps to work". However, Mr. Elia sheds light on change that he believes must be achieved on a larger, cultural scale to improve his working conditions: "What does a farmer need to feed his goats? Consequently, what does agriculture need, you just get a tractor and plants and that's it. You just pick your plants

in two months and profit off them for a whole year. They don't understand that agriculture is more difficult, it's painful, especially now". This expressed pain highlights the responsibility of society as well when it comes to assisting the farmers, by not minimizing the intensity and importance of farmers' work. As for the expected role of the government in supporting the farmers, most of the interviewed agreed on the describing it as under-performant. Ms. Vera Sakr emphasizes that "competent people should be placed in their positions!". While stressing the importance of good governance in the maintenance and enhancement of an entire sector. On another hand, Youssef Lahoud's demands from the government were more specific. He expressed, "they should do a study to help the farmer to guide them on what type of fruits and vegetables they should plant. And of course, to work on exportation, because that is its role as a ministry. And every step it takes will make a big difference in the current situation". Therefore, other than the financial stability and assistance that farmers are in desperate need of, Mr. Lahoud asked for more planning and research to be conducted for the optimization of both the farmers' business and crops as well as the sector as a whole.

In conclusion, though each farmer expressed their needs with differing, specific examples and demands, the main focus centered around financial assistance as well as the presence and efficiency of governmental bodies' work, most notably in this case the financial and expert support of the Ministry of Agriculture.

2. From Expertise to Field: Experts' Insights on Farming Methods

By showcasing experts suggested and adopted practices a comparison can be drawn to determine whether these practices are being implemented by the interviewed farmers.

a. Improved Farming Practices

Many practices were suggested by the interviewed experts to help farmers enhance their business. The more technical side of the advice given incorporated types of products to plant and new areas to delve into. Mr. Debbane suggested farmers to "try new types of agriculture like Thyme herbs." He specifically emphasized on products for agri-food industries, "The ideal solution is to plant vegetables or fruits that can be used in Industries because not everything can be merchandised." This comes in contrast with all that was done by the farmers, as the four interviewed farmers did not produce anything for the agri-food industry, nor were their main products planted herbs like thyme. In a similar sense, two other experts suggested approaches to adopt while farming. Roy Ayek suggested adopting the Integrated Pest Management method (IPM), as well as crop rotations, to reduce the need for pesticides and enhance product quality, "They need to follow the IPM, and they need to do crop rotations on their land." said Roy Ayek. Naim Khalil, though less technical in his suggestions, advised farmers to focus on the quality of their products, "A farmer should at first take care of his crops for a good income. A farmer should also stay up to date with all the new products that are hitting the markets. If it were apples, he should ask what kind of apple he should grow. The farmer should be aware about the time he should spray pesticides on his crops. So basically, everything he plants is a good income if he takes care of it." Mr. Khalil's advice can be taken to be a combination of the previous experts' given advice. However, he adds one idea that pertains to the marketing side of farming, claiming "He should take care of his crop and make it presentable. The importer will buy his crop either to ship it or to freeze it then export it." This marketing advice is supported by Rana Abdou who states, "He should concentrate on marketing, plant only the products that are in demand, and insure marketing for the products. They should plant products that have a market and a demand. They should diversify the planting, sorting by quality, and use enough quantities of pesticides and fertilizers. These are the main factors." Thus, marketing becomes an important aspect of farming practices to adopt in order to survive in today's market. When comparing the given advice to what the farmers actually do, one can notice that, for instance, though crop diversification exists, crop rotation is not being implemented. And though two of the four interviewed farmers use pesticides as minimally as possible, the other two, namely Toni Elia and Abdel Hamid Al Khashroum, had to utilize a bit more quantities than desired in order to prevent their crops from dying due to the unstable weather conditions. Furthermore, one farmer among the others interviewed reported developing expansion plans and attempting to plant new products for exportation. "All the little things that are very expensive and sold for high value are my coming project now, like blueberries, red berries, blackberries, and passion fruit." said Youssef Lahoud. Finally, when analyzing the findings of the interviews, it was concluded that the interviewed farmers did not implement any particular marketing strategies. In fact, they adopted none at all. Therefore, though already implementing some of the given advice, it can be determined that farmers' actual practices remain far from the ones suggested by experts. Nevertheless, a few particular observations arose from the interview with one expert, Soha Frem. In the interview with Mrs. Frem, it was noted that she too, similarly to some farmers, adopted traditional approaches to farming, specifically due to the traditional tools she utilizes, "We don't have a drip, we use the traditional way to irrigate the apple trees." She further explains, "We only have a tractor to cultivate and sprinkle the land, and normally the harvest is all done manually because after the crisis and issues that Lebanon is facing, we couldn't afford to buy new tools". This statement serves to prove the previously established hypothesis of farmers being unable

to update their approaches to their profession due to the lack of sufficient capital for buying the necessary tools. However, with the lack of capital and during difficult conditions, experts have shown the kind of adaptability and resilience portrayed by farmers. Soha Frem explains the story behind her company, Wata Cider "The idea started when the war in Syria affected the export of apples from the Lebanese market to Syria and Arab regions. The shipping routes by land were blocked and all export activities stopped and reached a 40% wastage due to overproduction. [...]" She follows this statement with "We started with one product, now we have a line of four, we diversified and increased the volume from 7,000 bottles to 50,000 Cider. We survived three years despite the hard conditions that we have been through especially during the last two. We are planning to export and increase the range of products to include sparkling non-alcoholic juices and to capitalize on the local market." Thus, portraying a great example of how innovative and adaptable Lebanese farmers and experts can be, rendering the potential for the agricultural sector's development a much more likely occurrence.

b. Addressing Farmer Needs

With all of the insightful information provided by the experts, as well as their expressed desire to see the sector progress, many suggestions veered toward development were given. These suggestions were presented to the farmers, society, and the public sector stakeholders as well. The experts believed that multiple actions should be taken toward improving the working conditions of farmers, and the suggested actions stemmed from these experts' perceived needs of the farmers and the sector as a whole. The first need determined was enhancing farmers' education and awareness. This objective could be tackled in three different ways, according to two experts. Henri Helou suggested the establishment of more research centers that would assist the farmer in any inquiry or situation needed. He said "I suggest you have special centers with specialized people to benefit the farmer. These centers take samples and study them. [...] You have to see what is available and have centers spread apart so that they don't waste time commuting to get a piece of paper telling them about it.". Thus, Mr. Helou believes that centers such as the LARI must be more spread out across the country so as to not force farmers to waste time commuting for the fast answers that they need. In complementary fashion, Roy Ayek suggested the implementation of more awareness-raising programs for farmers tailored specifically toward helping them pick the right inputs, "The farmers here need awareness on knowing that buying good seeds is one of the pillars of making a good harvest." This plan would, similarly to the one described by Mr. Helou, help farmers reduce the need for using excessive amounts of time on the treatment of diseases. Thus, time efficiency becomes a theme of focus when coming up with development plans. Third, on the topic of increasing awareness is the access to a unified data set as well as a pre-made plan that was also suggested by Mr. Helou. He said "We have to have a combined data through many ministries to reach optimum results." and adds "If you want to help the farmers, you have to give them a plan you can't tell them to make. [...] This plan should be about one page where every year they come up with what the market needs, like in Canada when every year they'll tell the people that they need nurses or engineers or high school students". This suggestion combines both the need for market studies and responsiveness, as well as the need for easily and readily accessible information. Whereas some experts emphasized farmers' need for awareness and education, others highlighted more primary needs like access to consistent and efficient infrastructure. Soha Frem tackles the issue, saying "we could really use support from infrastructure, water, and electricity supply. As a manufacturing plant in Keserwan, we do not have the space for sorting, packing, etc." Mrs. Frem's perception on the need for infrastructure mirrors the one expressed by farmers as well, for no development may be achieved if the basic conditions needed for sustainable and consistent farming are not rendered available. Furthermore, no farmer would be interested in more advanced practices or education if they cannot make their business run sustainably. Rana Abdou provides an example of that by stating "Before the COVID-19 pandemic, we were working on new concepts like decision agriculture, weather station, IPM, and early warning. But the people are not interested. It is not their priority because they will not be paid in dollars, their priority is to take care of their land." Thus, any development plans rely heavily on whether farmers receive their primary needs to run a business or not. When it comes to social actions taken to help the farmers, experts identified three dimensions that society as consumers can work on. The first consumer habit to amend is the request for imported products, exemplified by Mr. Helou in "The first thing that society can do is not to buy anything imported.", and "First, we need to protect the local produce by stopping the import of apples," said Ms. Frem. The second consumer tendency that needs to change, according to experts, is a consumer's habit of preferring well-packaged products over others, "People need to overlook the packaging as the quality is the same" added Mr. Helou. This suggestion coincides with previous experts' suggestions for farmers to improve their packaging and marketing plans. The final social action to be taken pertains more to activism. Indeed Mr. Helou claims that "Consumers can pressure The Ministry of Agriculture to track any residues on products and to see if they have traces of pesticides or not and if the farmers are spraying the vegetables in the right way or not." In this manner, society would play an active role in the agricultural sector and ensure its own food safety by actively demanding it. The final dimension discussed was the policy actions taken by the government to facilitate imports and exports. Naim Khalil provided a small example, "The Syrian Government imposes great costs on Lebanese farmers in what

concerns the transit expenses. If Syria decreases those costs, it will help the Lebanese exporting sector a lot." Mr. Khalil highlights one important aspect of the entire sector already discussed in the literature review; it is that of international relations' role in the development of Lebanese agriculture. Another side to the importation development plans is the facilitation of the importation of raw materials or pre-manufactured materials for agricultural and agri-food business. Soha Frem shares her own struggles with this matter and states, "Unfortunately, the government is not supportive of this, the facilitation of importing items from abroad such as glasses, caps, and labels, in addition to the bank's cooperation in order to facilitate payments transfers which are currently requiring lots of administrative work". This obstacle brings forth new stakeholders in the sector, which are banks and their role in providing farmers access to the necessary financing to start their project. This point was also discussed by Mr. Debbane where he shared "Farmers also need to get loans as they know what to plant and they have the qualifications but don't have the money. They need long term loans as harvesting takes time." This brings the research team back to the most recurrent need expressed by the farmers, which is financing. Thus, the experts shared multiple plans that tackled the needs expressed by the farmers and some that weren't.

c. Quality Control and Safety Measures

The focal point in this section revolves around the existence of any quality standards and guidelines set by private sector stakeholders or lack thereof, as well as farmers' adherence to these standards. The interviews with the experts yielded interesting results. The first finding pertained to the existence of the international quality certification of the Global G.A.P. Roy Ayek explained the process to go through prior and during the acquisition of the certification. "They have external and internal audits. The internal audit helps you to navigate every restriction. There are external audits that come from abroad. He pays attention to everything. The external audit comes once a year." Thus, not only does this certification prohibit farmers from using restricted products globally, it also takes into account local prohibitions established by the MOA. However, though internationally recognized and adopted, according to the discussion with Roy Ayek, very few are those that have sought to receive it in Lebanon: "I worked not long ago on some statistics and I found only 10 Holdings in Global G.A.P. and they weren't all agricultural, they were into agrifoods." said Roy Ayek. Having the very small numbered holdings that follow the Global G.A.P in Lebanon pertain mostly to the agri-food industry mirror very well the fact that, on a public and national scale, the only quality standards enforced in the field of agriculture are those belonging to the agri-food industry specifically. Confirmed by Rana Abdou, "There is nothing. Nobody knows what we are eating if we are talking about agriculture. But if we are talking about agro-food, yes there are standards for food security on the products, because if it is an industry or company then it should be registered, so the products should have specified regulations." and followed by "LIBNOR gives each product the standard it should follow. And if you need to export, you should follow the standard of Codex Alimentarius and see the regulations of the countries to which you are exporting. " Thus, from these few statements, the findings in the literature review stand true. The Ministry of Agriculture does not impose any quality standards on the farmers, it only prohibits the use of specific chemicals in fertilizers or pesticides. And with extra specifications being attributed to agro-industry products or products for exportation, locally sold products become less safe for consumers, mirroring Mrs. Abdou's opinion of "Nobody knows what we are eating" lest the Ministry of agriculture or other bodies regularly study the crop quality before its sale. With no specific standards set, thus, the only measures to take in order to ensure food safety are the farming procedures advised by experts like Roy Ayek, such as IPM and crop rotation.

d. Enhancing Food Security

Due to minimal information being present online pertaining to ensuring food security through agricultural plans, the six interviewed experts were asked whether they knew of any plans in the process of being made. The answers yielded no conclusive results, as they knew of no such plans in occurrence. However, some of the interviewed experts shared their points of view on what plans and actions can be done to advance toward this objective. "In my opinion, we should all be regrouped and sit to put a common strategy with an action plan with serious application. Even all the NGOs should work together and be cooperative. We should cooperate because not all the NGOs should work on the same project. Not everyone should work on the same project, everybody should work on a project that completes the other." In these statements, Rana Abdou starts by allocating responsibility to the main actors in the agricultural field. She brings to light an ongoing issue where NGOs implement unsustainable agricultural projects, for they all take on the same kind of project instead of cooperating to complement each other's work. Thus, Mrs. Abdou emphasizes small scale stakeholders' ability to achieve change and step forward toward more food security through agriculture. Rafi Debbane suggests utilizing empty or abandoned fields to work on achieving better food security. He suggests, "They can plant wheat in empty fields better than leaving them empty." When asked whether definitive plans could be made by the government to monitor and regulate what and how many products are being planted in Lebanon, he brings to light one obstacle, claiming "The government creates a program for this but not in capitalist countries." Instead, he suggests an alternative where "The government can give them [the farmers] incentives but they can't force them.". Thus, an incentives-based approach is advised to be implemented by the largest stakeholder in the agricultural industry. In this plan, however, Henri Helou highlights a key component to keep in mind and adopt, "Trust is really the most important thing because, if you forbid someone from planting a certain species and then you'll allow it for someone else, the farmer's not going to trust your words or follow it". Therefore, an important element in the implementation of any small-scale or large-scale plans for ensuring food security through agriculture is establishing trust between the different stakeholders of the sector. This trust was commonly observed not to be present, based on the frustration and aversions expressed by the farmers when discussing their interactions with experts and governmental bodies.

e. Agricultural Workforce Considerations

When discussing the agricultural labor force with experts, nationality and gender were focal points throughout this segment of the interview. An interesting trend to note on the topic of gender representation in the agricultural field arose when interviewing Soha Frem and Rana Abdou. Both women reported to be working men in the crop fields and women in the food processing part of their projects. Soha Frem says "Permanent employees have a monthly salary and they are all insured, men are usually the ones who handle the harvest process, but in the factory, we have women employees" while Rana Abdou declares "Yes we are working with cooperatives, stay-at-home women". Thus, it can be noted that many women are not active players in the agricultural field when it comes to hands-on tasks in the crop cycle due to a general preference to have men handle such laboring tasks. When it comes to the nationalities of the people working in the field, most specifically the full-time and seasonal laborers, a small contrast to the results acquired from the farmers' interviews arises. In Soha Frem's case, "We have an employee that is working on a full-time basis, he is permanent and ensured, and he takes care of the lands on a daily basis. During rush periods, there are two additional employees that help him and are also permanent and ensured. And once the harvest season is here, we hire workers who are paid on a daily basis, all Lebanese although it was hectic finding a good staff since we can't afford foreign employees any longer." From these several statements, one can observe how the number of permanent employees in the agricultural sector remains lower than that of seasonal ones. Nevertheless, and more importantly, Soha Frem brings to light the issue of foreign labor being more expensive than Lebanese one. If her claim were to be true, one would expect that more Lebanese people are being demanded to work in the sector. However, Rana Abdou claims otherwise, "The drivers are all Lebanese. But the agriculture sector counts on Syrian workers for the harvest and other tasks. They have the same cost as Lebanese workers, but the Lebanese don't like to do such tasks. But some tasks need some skilled Lebanese workers who are priced better." In direct contradiction to Mrs. Frem's case, Mrs. Abdou portrays a different reality for the agricultural labor force in Lebanon, one in which Lebanese people are more skilled, thus choosing to take on more challenging tasks than the foreign labor force. This task selectivity may explain why many claim it to be more common to find foreign people working in the agricultural sector than Lebanese. Nevertheless, with no official statistics portraying the true reality of the situation, and the last statistics of 2010 portraying the number of Lebanese workforces, the matter of labor force in the agricultural sector remains inconclusive.

3. From Policy to Practice: Evaluating Government Initiatives

This segment portrays the extent to which governmental bodies, particularly the Ministry of Agriculture, are implementing projects that satisfy the farmers' and experts' needs. It also showcases the suggestions given to farmers, society, and experts for the development of the sector as a whole.

a. Implemented Development Projects

When addressing the MOA representatives with the complaints and needs acquired from the interviewed farmers and experts, these members of the ministry explained the many actions taken toward the development of the sector from their end. The most recent project being implemented to help small farmers in particular is one in collaboration with the FAO and funded by the World Bank as well as Canada. This project aimed to help small farmers with the acquisition of a small amount of funds for buying agricultural inputs. They explained that 26,700 small farmers benefited from these vouchers. Medium and big farmers were unable to benefit from this project due to there being specific conditions to make sure that only small farmers that are struggling to stay afloat in the industry are given the extra help. In terms of educational development, as previously mentioned, the MOA updated the curricula for the farming technical schools between 2016 and 2017. However, in order to increase the number of interests in agriculture, the MOA advertised the field and its educational programs back in 2012. At that time, the number of students was reported to have increased. Nevertheless, 10 years after this endeavor, the number of people studying agriculture is on a steady decline, according to the MOA members. When it comes to providing the farmer with important information, beyond the scope of formal education and awareness-raising sessions, the MOA members shared that the LARI had established an application through which farmers could receive weather forecasts and updates on the most recent happenings in the field and optimal practices. However, much similar to the struggles expressed by the farmers, the LARI application had to be taken down due to the lack of necessary infrastructure to uphold it. Thus, infrastructure presents itself as a basic need for farmers, experts, and governmental bodies

as well. Finally, in the list of development plans assisting farmers with their needs, prior to the economic crisis, the MOA had been subsidizing some fees for exporting farmers, particularly the ones related to product testing before shipping. Unfortunately, these subsidies have been stopped, showcasing how the Ministry, much like all of the interviewed stakeholders, is also in need of proper funding in order to assist the key players in the agricultural sector properly. One investment that the ministry members said they would like to delve in, if given the proper resources, is technology. However, for any investment to be made, the Ministry representatives expressed their need to receive a larger budget allocated from the central government. The MOA representatives ended the interview with many suggestions addressed toward farmers and society alike. Farmers were advised to take many steps similarly expressed by previously interviewed experts. MOA representatives suggested that farmers watch out for how they spray pesticides on their products by using IPM. Other practices such as crop rotation were suggested as well. Two particular products they were suggested to plant, according to the latest international trends and demands, were thyme and saffron. Finally, farmers were advised to take better care of packaging their products and avoid putting the good products at the top of the crate and the damaged or lesser in quality at the bottom. Complementarily, the MOA representatives suggested that society, as identically expressed by Henri Helou, needs to stop going for the best-looking products, in order to encourage the buying of more local production as well as reducing the waste arising from this production. Thus, based on the extracted information from the MOA representatives, the suggestions and solutions advised by the experts are alike in every manner, just as the needs of both farmers and experts are the same as well.

b. Food Security Policies

Results acquired from the interview with the MOA representatives yielded no additional information related to food security plans than the results already established with the experts and farmers. Thus, it was concluded that neither the Ministry of Agriculture nor the central government has established any plans, policies, or budget pertaining to ensuring local food demand in case of emergencies. However, the MOA members did describe two instances in which emergency measures had to be taken in cases of major local insufficiency and overproduction. The first case dates back to the global economic crisis of 2008, where the central government allocated more money to the importation of agricultural food products for local consumption. The second example took place during the beginning of the Syrian crisis where Lebanon also witnessed a large overproduction of apples. During that instance, it was the Lebanese military that intervened, not the government, and bought multiple large quantities of apples from farmers. These examples showcase how much of the system that Lebanese farmers

and even governmental bodies rely on are treatment measures instead of planning and establishing preventive measures.

c. Quality Control and Safety Measures

Mr. Naim Khalil explained how it was the Ministry's role in making sure of the quality of products meant for exportation, "The ministry of Agriculture is responsible for checking the quality of the export." said Naim Khalil. However, there was no mention of whether the Ministry was conducting regular quality checkups on the products meant for local consumption. When asked about this specific matter, the MOA members expressed how, in the LARI labs, regular checks on soil type and conformity of plants to quality standards are being conducted. However, these checks are being done upon request. Thus, as expressed in the previous section, the tendency of relying on treatment measures instead of adopting preventive measures is put at the forefront, and Mrs. Abdou's statement takes center stage once more, in which she states that "Nobody knows what we are eating if we are talking about agriculture."

d. Agriculture Policy Reforms

In response to the concerns raised by farmers and experts regarding the development of the agricultural sector, there have been calls for targeted political actions aimed at facilitating its growth and ensuring smooth procedures. Despite the absence of confirmed actions in the interviews conducted with Ministry of Agriculture (MOA) representatives, valuable insights were provided by these members regarding a noteworthy initiative undertaken to address some of the challenges faced by farmers.

One such initiative involved the proposal to establish a "Control Order" on wholesale markets, which would grant the MOA the authority to oversee and regulate the operations within these markets, thereby preventing any unfair practices or injustices. The intention behind this proposal was to enhance transparency and fairness in the agricultural marketplace. However, it is important to note that the proposed control order was ultimately rejected, highlighting a significant obstacle impeding the progress of the agricultural sector—namely, political factors such as corruption within the governance system.

The rejection of the control order not only signifies a missed opportunity to improve revenue conditions for farmers but also underscores the broader challenge of addressing political corruption in the agricultural domain. This obstacle poses a considerable hindrance to the advancement of the sector, as it undermines efforts to establish an equitable and conducive environment for agricultural activities.

Therefore, it becomes evident that while the demand for specific political actions to propel the agricultural sector forward persists, the presence of political obstacles, including corruption within governance, must be acknowledged and addressed. It is essential for stakeholders, to collaborate and work towards systemic reforms that promote transparency, accountability, and fair practices, ultimately facilitating the desired development and growth of the agricultural sector.

Chapter III

A Roadmap for Sustainable Agriculture

III

A Roadmap for Sustainable Agriculture

The prosperity of Lebanon's agriculture rests on the delicate equilibrium between meeting present needs and ensuring a bountiful future for generations to come. This equilibrium necessitates a harmonious interplay of natural resource management, human endeavors, and economic vitality. Preserving and enhancing the quality of resources, including land, labor, capital, and entrepreneurial spirit, while utilizing them sustainably for regeneration, defines the essence of this pursuit.

Within this segment, a comprehensive roadmap emerges, charting the course for Lebanon's agricultural sector's progression. This roadmap is thoughtfully structured around the fundamental roles of stakeholders deeply concerned with this domain. While the government holds the reins of leadership and administration for proactive measures to stabilize and elevate the agriculture sector, the reality often falls short due to challenges like corruption, economic turmoil, and a dearth of long-term vision. This void necessitates the intervention of all concerned stakeholders, most notably the farming community and the society at large.

These proactive interventions cover a wide range of actions, from holding accountable those responsible for their actions to implementing protective measures that strengthen the agricultural sector against vulnerabilities. Essentially, this proactive involvement shapes the course of Lebanon's agricultural landscape, imbuing it with growth, resilience, and eventual success. In the following sections, the specific contributions of each stakeholder are explained, highlighting how their collaborative efforts shape the future of agriculture in Lebanon.

The recommended measures and actions proposed below are advised to be promptly executed. Stemming from a synthesis of evidence-based insights and theory-driven approaches, these recommendations are rooted in the identified challenges and opportunities within the sector. The resulting strategies offer practical and comprehensive solutions that the government, farmers and society can adopt to foster positive change.

A. Government

The landscape of agricultural services, encompassing development, regulation, and delivery, stands under the influence of public institutions. Drawing upon extensive desk reviews, literature evaluations, statistical investigations, and a multitude of stakeholder interviews, a recurrent realization emerged: a notable lack of governmental and Ministry of Agriculture interventions in pivotal sectors. This void extends to critical areas like monitoring, quality control, planning, and strategic interventions. These revelations underscore a pressing need for robust governmental engagement.

The observed gaps in monitoring, quality control, planning, and interventions within the agricultural domain highlight a clear call for strategic interventions. As the foundation of regulatory and developmental frameworks, governmental bodies, alongside the overarching government, shoulder the responsibility of adopting and translating the forthcoming recommendations into action. This adoption is essential to comprehensively address the identified shortcomings and to fortify the agricultural sector's foundation for sustained growth and success.

1. Enhancing Mapping

The initial responsibility of the government entails conducting a meticulous land mapping process for a robust and sustainable agricultural sector. These surveys should involve detailed soil examinations to identify the list of the most suitable priority crops for cultivation in each specific area. It is equally crucial to map various influential factors, such as water demand, prevailing weather conditions, electricity requirements, humidity levels, and other relevant variables. In addition to understanding the physical attributes of the land, assessing the needed technical skills and expertise of local farmers is a significant consideration. The expertise of those who cultivate the land directly influences the efficiency and sustainability of agricultural practices.

With this collected data, a nuanced analysis can be conducted to create a national agricultural plan. This plan places a strong emphasis on prioritizing natural planting methods, minimizing reliance on tents or other artificial structures. This focus on organic planting techniques fosters a sustainable and environmentally friendly approach to agriculture, providing farmers and stakeholders with actionable insights based on empirical data.

The effective drafting and functioning of this information system hinges on conducting regular agricultural land surveys mandated by the responsible governmental entities.

2. Data Integration

Empowering the agricultural sector involves taking the relevant measures and administering standardized surveys to farmers, to statistically track vulnerabilities, monitor potentials and deficiencies. The content is required to contain GIS (Geographic Information System) mapping, featuring areas by plot, altitudes, land cover/land use, future master planning and zoning, soil type, irrigation network accessibility, available water resources and

their points of connection, and crop types specific to the region/plots and the optimal crops according to the determined soil type. Mitigation practices and prevention measures should be suggested, when it comes to common diseases and problems, in a discussion-based forum under the supervision and approval of national labs, agricultural pharmacies, research centers and related Ministries. The forum will be a dedicated space for sharing expected yields and previous season effective yields along with the type of plantation and introducing parameters for local market studies. It is also practicable for the sector to publish all subsidies, services and privileges or incentives allocated for agriculture, all on the same platform. Nevertheless 'Agvisor' by LARI and 'Lebanon GIS portal' by WFP are in an attempt to cover these inquiries, yet their data is still insufficient. The complete digitalization of agricultural data ought to establish a system that simplifies the conduction of a ten-year census, potentially reducing the time period between each one as well. Furthermore, it paves the way for faster preemptive interventions to avoid overproduction or underproduction of a certain crop which might severely alter any food security plans.

3. Knowledge Sharing

It is essential to institute a centralized information system under the purview of appropriate public authorities. This system would house comprehensive data sets related to varied aspects of agricultural land, including utilized, idle, and potential agricultural zones.

a. A Digital Strategy

Establishing a digital agricultural strategy requires founding an administration or a department in existing public administrations responsible for providing and updating all digital material available for the public and the authorities. Therefore, setting a budgeted digitization strategy is expected to result in two outcomes specialized for agriculture and development. The desired online platform, in this regard, must organize an interaction between different involved authorities and stakeholders such as farmers and retailers (machinery, seeds, and fertilizers providers) in a way that efficiently serves all, with an ease of access. Apart from the online digital portal, the administration will be additionally responsible for creating a suitable data-sharing intra-system between different public entities which will serve as a basis for inter-sectoral development. Moreover, it is also recommended to cover parts related to seeds development and quality affixing harvesting techniques.

b. An Online Platform

Giving the public and commercial sectors access to useful data while painstakingly collecting crucial criteria is key to effective data gathering. Examples of stakeholders who play a part in data collection and parameter evaluation include farmers, research institutions, and non-governmental organizations. But only a platform run by the government should be tasked with providing a structured interface. The government is encouraged to start providing assistance for digital solutions in light of this, designating a special budget for its implementation, frequent upgrades, and continuous maintenance.

The existing data regarding local demand and production, segmented by geographical area, is currently unreliable. Addressing this challenge necessitates comprehensive data collection from all cooperatives and registered farmers in the initial stages. This underscores the recommendation for governmental authorities to implement continuous data collection processes, tracking cultivation activities in terms of types and quantities. The insights gleaned from such data would contribute to the creation of an agricultural map, guiding diverse stakeholders to mitigate issues like overproduction, untapped potentials, and ultimately fostering profitability.

4. Agricultural Infrastructure

a. Water

In order to ensure a stable production, it is necessary to develop a reliable infrastructure, which includes considerations for storing water, recycling, and planning for shortages or droughts. Storing water, based on comprehensive studies taking into consideration the geographical area and environmental effects, is considered of paramount importance.

In this context, a broader vision needs consideration to diminish water waste in every aspect and to benefit from every water resource available. Guaranteeing water access, and its cleanliness used in agricultural activities and constant testing are essential. Regular water quality assessments should be conducted to monitor any potential contamination. Protocols and safety guidelines must be followed in each specific case. The presence of a systemic infrastructure eases the process of allocating the source, giving a direct and practical solution with appropriate measures to be implemented to mitigate the issue and ensure the safety of the water supply.

Moreover, allowing private entities to procure water quantities from private sources like investments in atmospheric water generators, desalination technology, fog and rainwater harvesting and water filtration and purification technologies or public sources like springs or wells, after its regulation of access and distribution, would need a comprehensive monitoring system for quality and safety of use. Also, the involvement of various governmental and non-governmental organizations is crucial. The Ministries of Environment and Energy and Water, along with institutions such as the Council for Development and Reconstruction (CDR), the Green Plan and Water establishments, the Litani River Authority (LRA), and Municipalities, should collaborate to develop effective water management strategies. Additionally, coordination with financial institutions, including Agricultural Finance, IDAL, the Ministry of Economy and Trade, the Ministry of Finance, the Lebanese Central Bank (BdL), and the private banking sector, is essential to secure the necessary funding for infrastructure development and maintenance.

To achieve efficient communication and planning, the intra-system and inter-sectoral coordination should be established. By

working together, the government and relevant organizations can determine water requirements per area and identify suitable plots for agriculture in the national master plan. This integrated approach allows for the design and implementation of a comprehensive water distribution network, including connection points with appropriate volumetric capacities.

b. Energy

The implementation of conservation practices in the agricultural sector is also crucial for sustainable farming. A resilient and dependable electrical infrastructure is vital, particularly for water provision to farming facilities. Given the current situation in Lebanon, relying solely on the national electrical network is not a feasible option. Therefore, it becomes essential to incorporate temporary electricity measures such as diesel generators. To support this plan, the establishment of a registry specified for farmers with private power generators is imperative. This registry would provide valuable information on pricing details and energy transfer rates for each farm, ensuring uninterrupted operations.

Additionally, to further ensure a sustainable and diversified energy supply, it is crucial to explore renewable energy options. While conventional sources can offer immediate relief, long-term solutions should prioritize the integration of renewable energy sources, preferably green energy. Exploring innovative technological strategies and alternative energy solutions is key to promoting sustainable farming practices. The direct utilization of green energy from the source, such as solar panels and wind turbines, without the need for intermediate power supply mechanisms such as batteries, offers a more efficient approach. However, the more essential the point recipient of such energy is, the more layers within the risk contingency plan should be, to ensure that the extreme consequences occur with the lowest probability.

c. Storage Solutions

Addressing Lebanon's current crises characterized by electrical shortages, insufficient funding for national storage facilities, and the devastation caused by the port explosion, it is imperative to swiftly construct new storage facilities to safeguard food security. Primarily, the selection of facility locations should be guided by considerations such as conservational requirements for various products, and accessibility for relevant stakeholders. Prior to construction, careful examination of land prices is essential to ensure optimal utilization of the chosen location. Additionally, a comprehensive assessment of product accessibility is necessary to ascertain the origin of said product and transportation logistics, whether sourced locally or imported.

For imported goods, factors such as their country of origin, delivery time, transportation to the facility, and associated costs must be thoroughly evaluated leading to data-driven solutions. While port silos offer immediate and practical storage options, it is vital to weigh the prices to be paid for such lands and explore alternative investment opportunities for the government and other stakeholders.

Utilizing natural weather and land conditions would benefit the sustainability of such constructions, but including green energy sources within the plan of operation would optimize sustainability, and minimize the risks caused by any infrastructure failure, something well known to happen in Lebanon.

Distribution of the product and the location's potential as a productive dispersion hub are additional important post-storage factors to take into account. Even while choosing a good site may result in higher costs, the ensuing benefits in productivity in the phases of manufacturing, distribution, and delivery would surpass these costs. Therefore, a thorough strategy is essential, taking into account the facility, product specifications, and environmental conditions. It could be expensive to upgrade the facility to meet product demands, but this cost could be reduced by looking at better site options.

Lastly, considering the risks of acts of war, terrorism, and natural disasters damaging the facilities would entail diversifying the locations where such buildings might be positioned in a strategic plan reflecting all measures and safe distances required to minimize the risks involved.

d. Supply Chain

According to Cornwell & Ackerly (2010), there are five criteria pertaining to transportation that negatively impact raw agricultural products and food. The lack of proper temperature control, harmful loading and shipping practices resulting in potential cross-contamination are all barriers to the maintenance of the original high quality of the fruits and vegetables being transported to markets. In the case of Lebanon and its plurality of unregistered inter-border transportation, the aforementioned risks are significantly more likely to occur. Thus, in order to control the quality of transportation procedures, a unified agricultural transportation system must be established, one that is continuously monitored, inspected, and maintained. Several key steps should be considered:

- Vehicle Maintenance and Inspection: Regularly inspect and maintain transport vehicles to ensure they are in optimal condition.
- Driver Qualifications: Ensure that drivers possess valid licenses and undergo proper training in safe handling of agricultural products during transportation.
- Hygiene and Cleanliness: Maintain cleanliness of vehicles to prevent contamination. Regular cleaning and sanitization are essential, especially for vehicles carrying food products.
- Quality Control Checks: Implement quality control checks before, during, and after transportation. Regularly inspect products for damage, spoilage, or signs of contamination.
- Packaging and Stacking: Ensure proper packaging of agricultural products to prevent bruising, crushing, or exposure to external elements.

- Documentation and Traceability: Maintain accurate records of transported products, including origin, destination, batch numbers, and time of transport.
- Emergency Response Plan: Develop a comprehensive emergency response plan that outlines steps to be taken in case of accidents, breakdowns, or other unforeseen incidents.

5. Sector's Economic Upturn

a. Monitoring National and International Market Prices

Providing an acceptable range of market prices for agricultural products in developing countries is a critical priority, as emphasized by Kanbur (2020). To achieve this, it is imperative to maintain vigilant monitoring of market prices within the agricultural sector.

It is vital to monitor the internal market and gain insight into the acceptable range of prices, the nature of fluctuations, and the underlying causes behind them. These aspects play a pivotal role in formulating a comprehensive plan aimed at ensuring the stability and growth of the agricultural economy. By proactively addressing challenges and implementing strategies to supervise the market, the government would not only support the livelihoods of farmers but also foster sustainable agricultural development.

This monitoring extends beyond domestic markets and includes a comparative analysis with international markets. By carefully examining parameters like supply and demand, importing and exporting sources, transportation, logistics, and factors influencing price fluctuations, a deep understanding of market dynamics can be gained. This understanding encompasses evaluating the supply and demand ratio, the shape of curves, periodic sequences, and other factors affecting market volatility.

Through a combination of diligent monitoring, thoughtful analysis, and strategic interventions, we can create an environment that promotes fair pricing in a free market, protects the interests of farmers, and facilitates the long-term prosperity of the agricultural sector.

b. Monitoring Import-Export Data

In order to facilitate effective agricultural trade, it is essential to monitor and track both domestic and imported agricultural products at a national level. This includes implementing comprehensive labeling systems to specify the nature of these products and their country of origin. Additionally, it is crucial to categorize imported products based on whether they are re-exported, processed, or consumed domestically, as the current data provided by the Lebanese customs website offers only general product numbers.

To foster competitive advantage is the first step in trade. To make it happen, it becomes imperative to investigate and analyze all imported and exported agricultural products in order to be aware of all direct and indirect incurred costs. This analysis should identify potential areas where Lebanon can effectively compete in terms of standards, pricing, and market demand. By understanding these parameters, Lebanon can deliberately position itself in the international market.

Such strategic analysis is required to explore potential opportunities where Lebanon can enhance its agricultural production and increase profitability. For instance, if Lebanon currently exports a specific crop or product to a particular country, and that country further processes and exports the product to other markets, it may be worthwhile for Lebanon to consider producing the product locally and directly exporting it to the end user. This approach has the potential to generate additional profits for Lebanon, widening the areas of expertise and opening new employment opportunities.

c. Open Markets

Many farmers send their harvest to wholesale markets in major cities. These wholesalers sell these agricultural products at varying prices and the point of reference on these sales is the wholesalers themselves. This lack of diversity in sources opens the door for lying, and price manipulation, and may result in embezzlement in some extreme cases. Consequently, farmers may receive news of lower prices while the wholesalers generated much larger profits. For this reason, it is suggested that wholesale markets be monitored extensively and audited in a systematic way, in order to ensure the preservation of the financial rights of the farmers while providing the best price-to-quality ratio to the end user. The transparency of these sales transactions must be regulated with specific guidelines and pricing breakdowns to decrease information asymmetry. The pricing formulation shall contain variables (quality, volume, turnover, special storage...) upon which the final price results across all markets. Such guidelines and formulations may also be used in a new wholesale market approach; one that can be initiated by farmers, regulated and subsidized by the government with minimal profit to cover only expenses and maintenance for sustainability, with a benefit to direct stakeholders. Such approaches are more socially oriented benefiting both the farmer and the end-user. Farmers sell their produce and get the highest profit possible, while the end users receive fresh products with ranked quality at the minimum price possible.

Thus, the government can cover its operational costs while ensuring the satisfaction of all influenced/influencing stakeholders. Most importantly, it would have created a smooth sustainable cycle, facilitated the whole process and improved its citizens' socio-economic welfare.

d. Combating Illegal Imports

It is imperative to closely observe and monitor wholesale markets, specifically to identify and address the problem of illegal imports. In the Philippines, the detrimental effects of such imports on farmers are alarming, with 1,007,000 individuals losing their livelihoods due to the unrelenting inflow of unlawfully imported agricultural products (Peña, 2021).

Addressing the issue of illegal imports entails adopting a two-pronged approach. Firstly, it is crucial to strengthen border control and enhance import governance. By implementing robust monitoring and governing mechanisms at borders and import portals, authorities can effectively curb the entry of illegal agricultural products. Secondly, differentiating local produce from possible illegally imported goods becomes key in protecting local farmers and maintaining the balance of the local economic cycle.

A comprehensive strategy involves studying illegally imported produce to understand the reasons behind its demand and popularity in the local market. Simultaneously, evaluating the unique attributes of local produce, such as exceptional quality, distinct characteristics, and the unmatched expertise of local farmers, becomes crucial, especially in times of political instability.

In this context, establishing well-defined guidelines and procedures (from farmers to selling points and from legally imported destinations to local markets) is essential. This systematic approach enables the identification of illegally imported goods, facilitates the imposition of fines on illicit selling points, and then utilizes the generated revenue to support local farmers.

Through this coordinated effort, a more balanced and sustainable agricultural sector can be achieved, reducing the impact of illegal activities and fostering the growth and stability of the local farming community.

e. Setting the Quality Bar

The study has identified a lack of a specific standard of quality for individual agricultural products within the Ministry of Agriculture in Lebanon. This presents a challenge as farmers currently rely on their inherited knowledge to assess the quality of their crops. To address this, it is imperative to establish a unified standard of product quality to ensure the provision of safe and consumable goods.

An effective model to consider is the "Commodity Specifications" developed by the United States Department of Agriculture (USDA). These specifications define different grades for each level of quality, along with requirements for packaging, storage, and shipping. The USDA website serves as a valuable resource, offering comprehensive information on product quality standards.

In order to maintain a high level of product quality, it is essential to reach a consensus on, document, and make easily accessible a unified standard of quality. This should include detailed descriptions and specifications that farmers can readily adhere to. Additionally, it is advantageous to reference international standards, such as those established by the United Nations Committee on Trade and Development (UNCTAD) or individual countries' specifications. Accessing this information through the Ministry of Agriculture's website, including relevant programs like the TASDIER program of the Chambers of Commerce, can provide valuable insights into international standards and best practices.

It is additionally vital for the government to take a proactive role in establishing the standards for product quality. This involves defining clear consequences, incentives, and monitoring mechanisms to ensure compliance. The overarching goal should prioritize food safety, considering both its direct and indirect, short-term and long-term effects.

By implementing and enforcing these standards, the Lebanese government can ensure the well-being of its citizens and cultivate a reputation for producing safe and high-quality agricultural products.

f. Upholding Standards

To ensure good quality and food safety in Lebanon's agri-food sector, it is essential to establish a comprehensive monitoring system. This system should encompass multiple levels, including soil management, pesticide usage, and other factors that contribute to product quality. The existing challenge lies in consumers' limited ability to accurately assess product quality, often relying solely on factors such as appearance, price, and taste. As a result, the shortcomings or misconduct of farmers may go unnoticed, and the long-term effects on food safety remain undetermined, posing risks on consumer well-being and the overall integrity of the food industry.

To address this challenge, it is imperative to establish a robust monitoring system that meticulously examines all relevant parameters, but its application requires adequate financial resources. If the traditional approach of government funding is not feasible, alternative methods can be employed to make this strategy manageable. One such approach involves implementing a certificate system that offers different quality ranges, from optimal to premium, accompanied by corresponding certificates. Farmers will have to actively seek these certificates and invest in acquiring them. This financial commitment made by farmers to obtain these certificates will pay back through increased customer demand, enhanced reputation, strengthened customer trust, and ultimately increased profitability.

To implement this certificate system, the government can directly serve as the appraiser and provider of certificates, or it can collaborate with certified private companies However, a particularly important step would be for the government to form partnerships with international entities to effectively implement these certifications. This international collaboration can provide an additional layer of oversight and expertise, which is highly recommended to ensure the credibility and impartiality of the certification process.

Certificates would be assigned relative specific price ranges depending on selective criteria to prevent high or low pricing. Over time, customers will become familiar with this culture, implicitly supervising and assessing the process. Additionally, the higher the certificate attained by a farmer, the greater the percentage of tax exemption he/she may receive. Applying such a system discourages tax evasion, as farmers will have tax reliefs depending on the certificate acquired. As a result, farmers will be motivated to improve the quality of their products, leading to enhanced income, tax exemption, and overall quality improvement.

Furthermore, accountability strategies may be applied to ensure the consistency of such systems. Resellers will be responsible to ensure that they purchased the products from registered suppliers, while wholesale markets must provide documentation of their purchases from registered farmers. This process motivates farmers to register and submit their produce for quality control.

Finally, it is important to address any case where illegal products are combined with legal ones, as it may jeopardize the whole process. Therefore, it is necessary to conduct data comparisons between sellers and the main source, along with thorough periodical documentation checks. Regular monitoring of seller markets, transportation methods, and the employment of extensive fines and legal implications for those involved in malpractices will further safeguard the integrity of the supply chain.

g. Market Integration for Quality-Driven Local Produce

After conducting this comprehensive land mapping exercise and acquiring certificates that considers various farming parameters, including soil management, pesticide usage, and other factors impacting product quality, a detailed proposal for potential plantations can be developed. Feasibility studies are then conducted, considering expertise parameters to determine the most suitable locations for the plantations.

After considering all the factors mentioned above, it is of utmost importance to integrate supply and demand with import and export data into the analysis. This step is critical in identifying rare products that have the potential to be grown locally, offering a quality advantage through naturally grown methods, even with limited technological advancements and funding compared to other agricultural countries. Following this sequence, it becomes essential to determine the optimal markets for these products, taking into account various factors such as transportation distance, associated costs, and the recipient country's policies on imported goods, imposed taxes, treaties and all relevant considerations.

By carefully considering these aspects, we can strategically position the products and maximize their market potential.

h. Climate Smart Agriculture

CSA supports reaching internationally agreed goals such as the SDGs and the Paris Agreement. It aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible. What constitutes a CSA practice is context-specific, depending on local socio-economic, environmental and climate change factors. FAO recommends the approach be implemented through five action points: expanding the evidence base for CSA, supporting enabling policy frameworks, strengthening national and local institutions, enhancing funding, and financing options, and implementing CSA practices at the field level.

6. Food Security

Lebanon is clubbed with middle-range countries in food security. In fact, Lebanon imports 85% of its food (USD 20,000,000,000 annually), and 49% of Lebanese are reportedly worried about their ability to access enough food, while 31% stated that they were unable to eat healthy and nutritious food over the course of a year (Awwad, 2020). The following relevant measures are recommended for immediate execution to preserve certain food security in the country:

a. Data-Driven Planning and Task Allocation

To ensure that all consumption needs are met, the bodies responsible for food security (Ministries of Agriculture, Economy and Trade, Industry, Social Affairs, Environment, Energy & Water, and Health) must establish a cohesive and comprehensive plan incorporating the below criteria:

- Assessing the fundamental nutritional requirements and identifying the corresponding agricultural products necessary to meet them effectively.
- Analyzing the overall consumption needs based on a periodic analysis to ensure the availability of said product throughout the year while taking relevant costs into consideration.
- Evaluating the feasibility of procuring agricultural products both locally and through imports, considering factors such as quality assurance and the ability to reinforce accountability.
- Conducting a comprehensive cost analysis for the procurement process, taking into account various expenses and financial considerations.
- Undertaking a thorough feasibility study encompassing all relevant factors, including storage facilities, transportation infrastructure, political influences, and existing exchange treaties.
- Developing a holistic action plan that incentivizes farmers and importers to ensure the availability and accessibility of essential products for all classes of the population. Establishing clear intervention thresholds for the government to step in and take necessary actions when required.

Due to the plurality of the concerned bodies, and to ensure effective management, it is highly recommended to establish a dedicated

league or directorate responsible for food security, safety, and quality, similar to France's approach. which has allocated food security and safety concerns to the Directorate General for Food according to their website.

b. Strategic Planning instead of Emergency Response

In a broader context, the government should consistently allocate a specific budget for the provision of food products, both agricultural and agri-food. This approach would promote the sustainability and feasibility of long-term food security plans, moving away from the frequent reliance on emergency interventions, such as those outlined by the Ministry of Economy and Trade in 2022.

The recent crisis involving Ukraine illustrates the urgent need for strategic planning instead of emergency response. Lebanon's heavy reliance on Ukrainian wheat imports exposed the country to significant risk when conflict erupted in the region. Though foreign wheat negotiations were explored, such as the World Bank's approval of a USD 150,000,000 loan to assist Lebanon in funding wheat imports and stabilizing bread prices for nine months (World Bank, 2021), this was a reactive measure. Further international discussions must be conducted promptly to ensure national stability and self-sufficiency in the future.

Considering the Lebanese context, the country is exposed to several internal and external factors that imply their negative impact on the sector of agriculture. Whether related to market stability or food security, Lebanon does not possess an emergency conservation program. Agriculture risk coverage of the American reform act of the congress sets and defines immediate adaptation methods to geo-political, social and natural changes (American Congress, 2018). Thus, it is recommended that risk mitigation plans for the agricultural sector are established, similar to the USA's agricultural risk coverage. In that manner, once a problem arises, substitutes must be considered by a specific authority, studied by different accredited entities, and applied by the bewildering parties (both Public and non-governmental).

c. Food Waste Prevention and Utilization

A less commonly discussed hindrance to the provision of food security to all Lebanese citizens is the mismanagement of food waste. Following the example of the Republic of France, food waste can be utilized to provide people living in and below poverty with the nutrition they could not afford. This scheme may become equally beneficial to markets as well as consumers if the right incentives are put into place. In the example of France (Zero waste Europe, 2016), retail markets are not allowed to throw away or destroy unsold food products. If destructions are recorded, these retail markets are subjected to fines that may reach up to 0.1% of the annual turnover. However, no specific amount or percentage of the unsold food products to be donated is set, giving shop owners more liberty to choose and maximize profit. Furthermore, to encourage retailers to donate their food instead of wasting it, French retailers were able to benefit from up to 60% tax break on the value of the donated food, lessening the financial loss arising from the actions (Saltzman, 2019). Thus, an adaptation to the Lebanese context may come in the form of:

- Placing fines on destroyed, unsold food. The money arising from the fines can be used to finance the provision of nutritious needs when needed, and it can also be used to provide markets with the below incentive.
- Establishing a certain percentage of tax breaks on the amount of food donated to trustworthy and established charities and NGOs (keeping in mind that the NGOs will be given a background check to determine their level of corruption).
- Following on the NGOs' circulation and donation of food products to the people with no sufficient purchasing power to sustain themselves on their own.

7. Incentives for an Informed Decision

The next step for the government is to synergize the potential plantations recommended by the information system with the expertise and perceptions of the farmers involved. This can be achieved by offering targeted farming incentives that encourage the implementation of the comprehensive agricultural plan while adhering to stringent quality standards. Such a proactive strategy promotes the cultivation of crops in alignment with the unique soil conditions of each region, thereby advocating sustainable agricultural practices.

The main hindrance to the success of any business is the access to and sustainability of financing. With the increasing inflation of products, affording to pay for registration fees and taxes while attempting to continuously meet the expenses on land maintenance and farming becomes an impossible feat to achieve for small and medium farmers. Therefore, the following facilitations and exemptions should be made to encourage more farmers to invest in agriculture as well as officially register their lands for more data accuracy and tracking.

a. Exemptions on Registration Fees

Seeing as expensive registration fees and their confusing procedures are usually the first obstacle toward new and potential investors within the field, exemptions on registration fees are recommended to be provided for farmers with land fitting specific criteria. Such financial facilitation is implemented in India and is specified in the Plant Variety Protection & Farmers' Rights (PPV&FR) Act of 2001 (Farmers' Rights in the PPV&FR Act, 2021). Agriculture, fishing and forestry constitute approximately 18% of the total GDP in India (World Bank, 2020), such an exemption can be utilized to encourage more people to invest in the agricultural sector without fearing the daunting amount of registration fees.

b. Exemptions on Taxes

Providing investors with exemptions on taxes if they meet certain conditions is not a new feat. The Investment Development Authority of Lebanon (IDAL) has already been giving tax breaks up to 10 years and incentives, through their Business Support Unit (BSU), to Lebanese and foreign companies, whether in the agricultural industry or not. Companies applying for tax exemptions must fit particular requirements to be given them (IDAL, 2020). However, such incentives must be maintained and expanded by the Ministry of Finance in joint collaboration with the Ministry of Agriculture to benefit small and medium farmers particularly, under the condition that they present comprehensive feasibility and business plans through the assistance of expertly obtained plot analysis. Furthermore, tax exemptions can be applied to food-processing institutions under the condition of acquiring food safety and quality certifications, such as the ISO. In that manner, the Ministries of Public Health, Agriculture, and Industry, can work in collaboration with ISO auditors to implement regular food safety checkups more consistently instead of relying on reporting. This ensures the enhancement and maintenance of the quality of Lebanese agri-food products, which, in turn, increases Lebanon's chance of competing in international agri-food markets if outstanding food quality is denoted.

c. Subsidies

The Ministry of Agriculture, in cooperation with the FAO, has been providing small and medium farmers with vouchers of 300 USD since 2020 (FAO, 2020). However, vouchers are insufficient when it comes to encouraging farmers, especially small and medium, to stay in the sector. Thus, subsidies are important incentives to include for the maintenance of the sector itself. Such subsidies may only be applied when taxes start to be collected from registered farmers, and the needed increase in farmer registration. Indeed, collected taxes may be applied to subsidize important, developmental aspects of the sector such as education (intermediate and higher), R&D, import/exportation procedures, loans provided to farmers, and lab testing.

8. Policies and Strategies

Given its limited adherence to laws and tax regulations compared to other industries, the agricultural sector predominantly operates within an informal framework. Consequently, there is a pressing need to institute regulations for the sector.

a. Registration Policies

As discussed numerously in the sections above, the lack of directory of all farmers most notably stems from a lack of official registration of these farmers within the sector, which hinders from their acquisition of benefits such as social security and hinders governmental bodies' ability to properly monitor and track any misconducts or harmful products. Hence arises the necessity of there being a clear set of registration policies and procedures to abide by. These procedures are expected to push the farmers to:

- Conduct a feasibility plan and business study of the plot, by referring to an expert's help. Such study must incorporate the budget of the project, the type of soil, climatic conditions, measurements, optimal plants to be planted, potential quantity and quality of plants, as well as step-by-step approaches if the plot will be technologically enhanced. A successful example of enforcing such procedures is observed in Singapore where the Singapore Food Agency has developed a detailed manual and guide on the individual procedures, plans, and steps to be taken until a farmer may receive his/her license for the plot of land (Singapore Food Agency, 2020).
- Actively register their lands more and not be daunted by the requirements due to their receiving an expert's help and approval.
- Legally commit to the implementation of safe farming practices and utilization of inputs permitted by the MOA.

However, establishing such registration policies must not come with the cost of posing a heavier financial load on farmers themselves. To make the registration policies less burdensome, incentives such as the one provided in the above section "Subsidies" must be implemented as well.

b. Extending Simulations and Strategies until the year 2050

The Lebanese NAS strategy, which is the main strategy governing the agricultural strategy, simulates the sector until the year 2025, while developed countries extend their projections till the year 2050, which should be a reference for our future planning.

c. Budgets & Funding

Budget for Digital Strategy: The success of developed countries highly relies on the fact that they set simulated targets, dedicate specific budgets and abide by fixed deadlines for their projects, especially the ones related to sectoral economic cycles, such as agriculture. Financing the existing national strategy has a 73% unclear gap, with an equal reliance on donor funds to governmental responsibility. For instance, the NAS 2020-2025 budget identified the total resources requirements for its implementation to around USD 710,500,000 with an estimated Governmental contribution of around 14%, matched by an equivalent amount from ongoing and

projected pipeline of donors, and a 73% financial gap to be covered by systematic resource mobilization. No allocations were considered to a digital agricultural strategy. NAS also states the following:' The two GD's suffer from the insufficiency of human resources and a chronic scarcity of financial resources. Many positions are vacant with more than 80% of positions occupied on an interim basis. The human resource problem is amplified by the scarcity of means of implementation of daily work, especially in agriculture centers mainly due to budgetary constraints. Furthermore, the coordination amongst departments and between regional offices and headquarters is hampered, due to limited digitalization of the workflow and administrative process. Therefore, it is highly recommended that any strategy contains a detailed budget for each action to be taken along the plan along with the source of funding for each one. Furthermore, as the MOA's NAS lacked a budget dedicated for the digitalization of the sector, it is also recommended that it consecrates one.

- Increasing Funding Resources: Once operating as an official and fully registered sector, the financing and budgeting of agriculture will increase due to multiple reasons:
  - The taxes obtained from the registered farmers
  - The profit obtained from the increased exportation of high quality agricultural and agri-food products
  - The fees obtained from farmers' breech on established standards and protocols
  - Funds obtained through negotiations with international funding institutions

All of these income sources will be used to fund multiple areas of the sector, ranging from the provision of basic food security to research and development projects, including education, sponsoring research labs and similar projects.

9. Pathways of Agricultural Progress

a. Free Educational Programs

To promote the prosperity of the agricultural sector, the government should implement a range of strategic initiatives. These efforts are designed to empower individuals within the industry with the necessary knowledge and skills to excel in a rapidly evolving landscape.

Firstly, a comprehensive approach to education is paramount. Integrating agriculture into primary and secondary school curriculums will cultivate an early interest in the sector among young learners. This foundational exposure can pave the way for a stronger connection to agricultural practices later n life. Furthermore, the establishment of specialized agricultural universities and colleges, developed in collaboration with international partners, will ensure that those seeking advanced knowledge have access to cutting-edge resources and expertise. Keeping the curriculum flexible and up-to-date with the latest developments is vital to mirror the dynamic nature of the agriculture industry.

To incentivize higher education in agriculture, the government should introduce scholarships and financial incentives for students pursuing agricultural studies. This will not only attract more individuals to the field but also facilitate the growth of a well-educated and skilled workforce.

Embracing modern agricultural technologies is another key aspect of these educational programs. Modules focusing on precision farming, drone usage, and data-driven decision-making tools should be included. By providing access to these cutting-edge tools, the government demonstrates its commitment to improving efficiency and productivity within the sector.

Additionally, maintaining awareness of market developments is essential for continuing performance. The government may assist people by teaching them about supply chain dynamics, market analysis, and consumer behavior. People may more effectively match their efforts to market demands thanks to the insights offered by this information, which increases profitability and reduces waste. Increasing the emphasis on agroecology, agricultural economics, and sustainable and regenerative agriculture in educational programs is also essential. This development will make sure that individuals have the abilities and information required to deal with the possibilities and difficulties of the future.

b. Training and Capacity Development

Comprehensive training initiatives should be prioritized by the government to promote ongoing progress in agricultural practices. These thoughtfully created programs are intended to provide farmers with the most recent information and useful skills necessary to flourish in today's quickly changing agricultural environment. These training programs include workshops, seminars, and courses that have been carefully designed to address both present problems and unrealized potential. This makes it possible for farmers to effectively adjust to the dynamic character of contemporary agriculture.

Flexibility is a crucial idea in this context. These training programs' curricula are nevertheless flexible, taking into account the most recent innovations and practical experiences that represent the changing agriculture business. This method gives farmers the ability to successfully foresee and handle future developments in addition to addressing current problems. The government's persistent dedication to fostering agricultural excellence is concretely demonstrated by these training initiatives.

Furthermore, these initiatives lay the foundation for a dynamic agricultural industry where innovation and practical experience converge, promoting sustained success. By providing accessible avenues for knowledge and skill growth, the government demonstrates its dedication to supporting agricultural advancement.

The government should set up programs for skill development, including regular training sessions for farmers on contemporary agricultural methods, environmental practices, and business management, in order to efficiently carry out these initiatives. To guarantee that training information reaches a larger audience, a mix of distribution techniques, including both physical and virtual platforms, should be used. In addition, specific initiatives should be developed to support women in agriculture and acknowledge their essential contributions to the industry. It is important to set up a strong extension service structure that provides ongoing assistance, direction, and advice to farmers as well as free advisory services for both commercial and agricultural matters.

c. Technological Integration

The government is at the forefront of driving the integration of technology within the agriculture industry, spearheading a comprehensive array of strategic initiatives. The cultivation of farmer knowledge of the many benefits of modern agriculture technology is a fundamental first step. In addition, the provision of financial incentives like as grants and subsidies can encourage investments in cutting-edge machinery. Collaborations with IT companies and research institutions result in the development of customized solutions that painstakingly cater to the unique requirements of Lebanon's agricultural terrain. Partnerships with educational institutions, the planning of technology demos, and a strong dedication to building a reliable digital infrastructure are all examples of how this collaborative spirit is used.

The government's constant commitment to enabling farmers to skillfully exploit the possibilities of technology is nestled within this pro-active paradigm. This is made possible through targeted funding for technology investments, the launch of pilot projects, and continuous support for initiatives in research and development. This innovative approach is intended to enhance the agriculture industry holistically as well as to increase production.

Following this strategic framework, there are clear steps to take. The first is to invest in Research and Development (R&D). When the government actively participates in this area, it encourages the development of new technologies that suit Lebanon's specific climate and soil. Partnering with private companies can enhance the potential for groundbreaking innovation.

This strategy's key component is to encourage the wider adoption of technology. The involvement of the government includes providing a variety of assistance programs, including grants, low-interest loans, and subsidies. This all-encompassing strategy does not only make it easier to buy cutting-edge equipment without any hassle, but it also acts as a conduit for the spread of new technologies. The creation of demonstration farms and displays is crucial for emphasizing the innovations' transformational effect. In addition, training courses teach useful skills that empower farmers to use technology to its full potential. Exploration of areas like renewable energy, biotechnology, and remote sensing, all of which have the potential to accelerate the trajectory of technological advancement, is included in a forward-looking viewpoint.

At the core of this multimodal strategy is the development of strong digital platforms. These platforms act as clearinghouses for a range of important data, such as market intelligence, weather predictions, and professional judgment. By enabling easy connection between farmers and pertinent specialists and enhancing information sharing, these platforms serve as dynamic knowledge hubs. A persistent commitment to creating a solid digital infrastructure, which supports the efficacy and efficiency of efforts driven by technology, is another factor supporting this. The launch of pilot projects and sizable investments in tech companies, in addition to these measures, combine to create a dynamic environment for the assessment, advancement, and eventual integration of breakthrough technology.

d. Collaborations and Partnerships

- Enhancing Trade Relations with Gulf Countries and Beyond: Maintaining and expanding trade relations with Gulf countries remains a priority due to the significance of their markets for Lebanese vegetable and fruit exports. Strengthening relationships with existing partners and establishing rapport with new markets, as recommended by the 2020 IDAL Factbook, will allow for further growth. Exploring opportunities in North African and Latin American countries, along with maximizing underutilized agreements like the concessions on agricultural exports with the EU through EFTA, are essential steps in expanding market reach.
- Diversifying Import Sources and Strengthening Relations: To reduce dependence on single sources of food imports, the government should foster cooperation with international funding institutions and nations that supply vital food products. By diversifying import sources, Lebanon can mitigate risks associated with over-reliance on a single entity. The Ukrainian situation serves as a reminder of the importance of proactive planning and the dangers of relying too heavily on one source. Negotiating exchange treaties that offer essential resources in return for Lebanon's necessities can strengthen the country's position in times of crisis.
- Creating a Dynamic Communication Network: Government leadership is pivotal in establishing a network that facilitates communication and coordination among various stakeholders. Regular gatherings, conferences, and seminars should be organized to provide a platform for farmers, specialists, and researchers to exchange ideas and innovative solutions. These initiatives foster collaboration and teamwork in addressing challenges and seizing opportunities within the agriculture sector.

Additionally, collaboration with research organizations and academic institutions is invaluable in gaining insights and staying current with the latest developments. This approach enhances cohesion, fosters common goals, and promotes active collaborations that enhance Lebanon's agricultural landscape. Integrating resources from various sectors maximizes program impact and resource utilization.

- Effective Regulatory Framework and International Collaboration: Transparency and effectiveness in the agriculture industry require a well-organized regulatory framework. Coordination among multiple government agencies, including finance, transportation, agriculture, and commerce, ensures a cohesive approach to policy implementation. Regular communication, shared databases, and aligned objectives are essential for effective coordination. Furthermore, collaboration with international agricultural organizations provides access to cutting-edge information and training materials, enhancing industry knowledge and techniques. Aligning local laws and practices with international norms not only enhances competitiveness abroad but also showcases commitment to excellence. Cross-border collaboration with neighboring countries facilitates the pooling of resources, collaborative research, and unified policies to collectively address challenges and seize opportunities.

e. Cooperatives & Syndicate Enhancement

The functioning of cooperatives and syndicates are majorly governed by Decrees and National Strategies and programs, therefore, the enhancement of both is suggested in the field of agriculture:

- Cooperatives Enhancement: The Lebanese government regulates three separate acts: The law of the cooperative associations' decree number 17199/1964 which was last amended in 1983. The executive decree for cooperative associations number 2989 enacted on 17/3/1972 was last amended on 21/6/1977.

  The managerial body of cooperatives is divided into three entities:

  - The Directorate General of Cooperatives: mandate includes the supervision and monitoring of cooperatives, and the provision of financial support to cooperatives and their unions in addition to the registration and issuance of permits.
  - The Lebanese Federation of Cooperatives (LFC): is the representative body of all registered cooperatives, by Decree 10659/1968, as per the decree the mandate of the LFC includes the promotion of cooperatives, coordinating relations with the government, training and capacity building. The Federation is still active, however, lacks financial resources to develop a large-scale and high-impact strategy and action plan.
  - The National Union for Cooperative Credit (NUCC): is mandated by law to regulate disbursement of credit to cooperatives – that are members of the union. However, membership of the union is frozen because of the low required action stock price (based on the old low and not adjusted for deflation nor for the Lebanese Pounds crash of the mid-1980s). In total 206 cooperatives are members of the UNCC, of which 93 still exist and out of which 23 are still active (ILO, 2018). The NUCC had approximately USD six million. in available cash that could be lent to cooperatives in 2018, and no recent information is available.

  However, by law, cooperatives are exempt from certain taxation, the most important being the exemption from profit tax, municipal rent tax and the municipal construction tax, finance fee on contracts, and tax on owned real estate. These exemptions have encouraged traders as well as exporters of fruits and vegetables to establish and register as cooperatives. Yet, despite the relatively high number of agricultural cooperatives, only 4.5%of registered farmers are members of a cooperative. This could be due to a lack of diversified specialization and its update and weak awareness programs or reach to farmers or vis accessibility. Cooperatives should also be specialized in tools and machinery circulation not only crop type. Lebanon should follow the model adopted in the US, where cooperatives are specialized in Marketing, supply, and service providers as well, which will increase their efficiency and amplify participation and memberships according to an ILO report. Segmenting the cooperatives as such and emphasizing their importance will increase their impact on the sector and may even increase employment opportunities, such as in Germany where over 20,000,000 German people are part of over 7,300 cooperatives, generating employment for over 900,000 people. So, to summarize recommended actions, more cooperatives need to be formed not only categorized by region and plant type, but also diversified in the field of marketing and service providing.

- Empowering Agricultural SMEs in Lebanon: The existing strategy to support SMEs in Lebanon in the agricultural sector can be summarized as extracted from the Lebanon SME Strategy: 'The situation points to the fact that SMEs have to ultimately orient themselves to external markets and rely on global supply chains to conduct their business. To support them, some efforts are noted including: MOET's Internationalization Support initiative to subsidize participation of Lebanese firms in global fairs, and IDAL's support to Agricultural and ICT firms through its sponsorship of local producers in global fairs as well as its Agri Plus and Agro Map Programs. The Qualeb project with the European Union to improve quality standards through training and workshops. More progress is required to support SME growth as they still face unlevel playing fields and several trading inefficiencies.

  Then if a closer examination of the Agro Map program takes place, it is highly noticed that the sector is ruled by the syndicate of industrialists and not agriculture. Establishing a Registered Syndicate for FarmersThe Syndicate of Lebanese Food Industrialists serves as the registration hub for exporters of agro-food products, an essential platform through which producers gain access to IDAL's support. Membership within the

syndicate is a prerequisite for availing this support, with over 180 agro-food producers currently registered. The main tasks outlined by IDAL in 2004 include offering Agro-Food exporters the platform to showcase their products at international fairs, introducing Lebanese products to foreign investors and buyers, and facilitating the integration of local producers with the latest technologies. While the Agro Map Program has established targeted goals, effective coordination with cooperatives and the establishment of a farmers' syndicate remain crucial for the successful implementation of IDAL's objectives.

In the pursuit of a more comprehensive approach, the role of a Unified Syndicate for farmers emerges as a critical factor. This syndicate would play a pivotal role in conducting geological surveys, developing databases, and undertaking specialized tasks that require expertise and specialized equipment. Presently, a multitude of unions and cooperatives within the agricultural sector exist, but they lack a unified structure. Some operate under the Ministry of Industry, focused solely on agri-food, while others are overseen by the Chambers of Commerce in various regions such as Zahle, South, and North. Although a syndicate for agricultural engineers exists, the recommendation stands to establish a unified and officially registered syndicate for farmers. This entity would be mandated by law to safeguard farmers' rights, rank its members, and guide them in the significance of data sharing and the measurement of diverse parameters. Such a syndicate would undoubtedly contribute to a more streamlined and coordinated approach, elevating the collective efforts to support Lebanon's agricultural sector.

f. Bullet Proofing the Agriculture Cycle

- Agricultural Upcycling: Utilizing Recycled Equipment: Starting with recycled plastic, the major material used for irrigation systems, pots, and hydroponic and aeroponic models, most of the equipment is imported and due to the worldwide prices inflation and the devaluation of the national currency, prices paid in foreign currencies became an obstacle for farmers and investors. The best substitute for environmentally friendly and economical affordability, is a local production of agricultural equipment. In the short to medium term, basic elements can be produced using only basic industrial equipment. Yet, in the long-term, high technological equipment can also be produced after the acquisition of know-how, complex machinery, and staff training agreements with international manufacturers. Highly technological equipment includes the recycling of metals, and electronic waste, which needs further industrial development and relies on the interaction between the agricultural sector and the industrial one; that is why it is considered as a long-term activity. Additionally, organic waste should be a resource for compost and fertilizers. This transformation also requires technological advancement or practicable techniques and land spaces. Knowing that Lebanon has already established a market for fertilizers based on re-selling, this section of the sector presents a promising profitable business that ought to solve part of the Lebanese crisis, related to solid waste management as well.

  To drive the development of recycling infrastructure and foster sustainable waste management practices, it is imperative to actively promote the establishment of recycling facilities. This can be achieved by engaging and empowering capable entrepreneurs and industrialists to initiate and operate recycling companies. By encouraging their involvement, Lebanon can effectively enhance its recycling ecosystem and create a robust framework for the efficient processing and reuse of recyclable materials.

  A comprehensive national study should be conducted to determine the local demand for recycled products and assess the specific requirements, including factors such as quantity, capacity, and other relevant considerations, of the recycling factories needed. The government plays a crucial role in this endeavor by providing targeted incentives exclusively tailored to meet this specific demand. The selection process for incentivized factories should prioritize factors such as quality, timely implementation, and other pertinent criteria. It is important to note that these incentives should be offered solely during the initial setup phase of this specific market. Once the recycling facilities are operational, the government should gradually phase out these incentives to avoid creating internal competition. This strategic transition will pave the way for a self-sustaining and thriving recycling economy in Lebanon.

- Optimizing Essential Produce for Longer Shelf Life and Cost Savings: In order to optimize the storage and preservation of essential produce in Lebanon's agriculture sector, a recommendation is to explore value-added processing techniques. By processing the produce into a form that occupies less space and can be stored for longer periods, farmers and producers can extend the shelf life of their harvest while minimizing costs. While processing may result in a slight loss of nutrients, the benefits of increased storage longevity and reduced expenses can outweigh this disadvantage.

  A simple and relevant example is the production of lemons, which have multiple uses in medicine and are rich in nutrients. However, storing lemons in refrigerated containers can be expensive knowing that they also have a short shelf-life.

To address this challenge, an alternative method can be adopted such as freezing the lemon juice. Optimizing storage space is key throughout this process, because it helps maintain the essence of the products while efficiently decreasing the operational costs.

To implement this recommendation effectively, it is crucial to establish proper processing and packaging protocols that maintain the quality and nutritional value of the product. Governmental efforts should focus on finding optimal processing techniques for specific crops, considering factors such as temperature control, packaging materials, and processing methods. By exploring innovative methods to maximize the potential of essential produce, the agriculture sector can achieve longer shelf life, cost savings, and improved utilization of available resources while still preserving significant nutrient content.

This approach aligns with sustainable practices and addresses the unique challenges faced in storage and preservation within the sector.

10. Raising Awareness

The responsibilities of the Ministry of Agriculture and other governmental bodies encompass not only policy formulation and decision-making but also the crucial task of disseminating these changes effectively to farmers. Without proper awareness and accessible information, even the most well-intentioned policies can lose their impact. In this context, the media assumes a pivotal role as a dynamic channel of communication, facilitating a reciprocal exchange between the government, farmers, and the wider society.

Undoubtedly, the media's swiftness and reach make it an indispensable tool in bridging informational gaps and fostering engagement. This assertion is underpinned by a study conducted by Okwu, Kuku, and Aba (2007) in Pakistan, which highlighted that farmer across the country actively seek agricultural information from news outlets, demonstrating their willingness to engage with initiatives aimed at enhancing the agricultural sector. A similar scenario unfolds in Lebanon, a developing nation, where media outlets play a vital role, as illustrated by Mugwisi (2015). This researcher emphasizes how governments strategically employ diverse media platforms to benefit farmers and society, disseminating vital information ranging from market prices to innovative farming techniques.

Drawing inspiration from these insights, the Lebanese government is well-positioned to harness the potential of media-driven strategies to enhance agricultural communication and responsiveness. Collaborating with CSOs and local agri-business stakeholders can yield compelling campaigns that showcase the modern face of agriculture. Emphasizing gender equality within the agricultural sector and highlighting the potential for agri-business opportunities can serve as powerful drivers of change.

Crafting messages that resonate is vital. Ensuring comprehensive coverage of policies and programs and framing them with a focus on entrepreneurship and innovation allows the government to effectively communicate its intentions. Timely dissemination of information about events, workshops, and market dynamics further strengthens the bond between the government and its stakeholders. Moreover, extending awareness campaigns to consumers by educating them about the nutritional quality of local produce and empowering them with knowledge about their rights and responsibilities can guide consumption patterns towards healthier and more sustainable choices.

B. Farmers

As the primary stakeholder, the government, falls short in fulfilling its pivotal responsibilities towards the sector, the determination of individual farmers and the collaborative endeavors of farming cooperatives shine even brighter.

Amid economic uncertainties and complex governance issues, individual farmers play a crucial role in providing sustenance. They bear the responsibility of feeding communities while dealing with challenges from an unpredictable economy. Their impact is felt directly within their communities. On the other hand, farming cooperatives highlight the power of collaboration. Cooperatives bring farmers together to pool resources, knowledge, and efforts. This approach transforms challenges into opportunities and amplifies impact. While the roadmap for individual farmers focuses on personal growth and adaptation, the cooperative model emphasizes collective action. Both paths converge on a shared commitment to agricultural prosperity, driven by the common goal of nurturing the land and securing livelihoods.

1. Individual Farmers

The challenges facing farmers today are substantial, yet they are not insurmountable. The outcomes of your efforts on the fields resonate throughout society. Consequently, this roadmap is meticulously crafted to provide you with guidance in enhancing product quality, increasing productivity, and bolstering income.

The following recommendations hold more than words on paper; they embody significant steps that can tangibly improve your life and the lives of those around you. Divided into several tiers, this guide comprehensively addresses various aspects of farming, from nurturing the soil to implementing intelligent marketing strategies.

Farming transcends being just a profession; it's a calling, a way of life that sustains us all. Together, we have the power to forge a more sustainable, prosperous, and resilient agricultural future. Your triumphs are integral to collective success, and this roadmap is steadfastly here to bolster every step of your journey.

a. Fostering a Business Mindset

Farming is more than a noble tradition passed down through generations; it's a complex and multifaceted business. The time has come for farmers to view this practice not merely as an inherited activity but as a thriving business. By adopting a business-like approach, farmers can elevate their practice, enhance productivity, and ensure long-term sustainability.

The transformation begins with adopting such kind of approach through feasibility studies. Conducting in-depth feasibility studies for clear business plans and long-term investments will guide farmers' decision-making and investment strategies, allowing them to understand the potential and limitations of their farms.

Water quality is another essential aspect. Testing water sources and obtaining certification for good quality water resources ensures the health of crops and livestock, while also serving as a valuable marketing tool.

Maintaining soil quality is equally vital. Conducting soil tests and obtaining certification for healthy soil is crucial for productivity and can be leveraged in marketing and sales.

Expertise must also be leveraged. Seeking guidance from Agricultural Extension specialists, Agronomists, Agricultural Engineers, Plant Pathologists, Horticulturists, Soil and Water Scientists, Agricultural Economists, Environmental Specialists, and Financial Advisors provides valuable insights and support in various farming areas.

Professional assistance is often necessary to navigate the complex legal and financial landscape of modern agriculture. Farmers should consider seeking free legal, audit, administrative, and fiscal advice from various sources to ensure compliance and financial stability. Non-Governmental Organizations (NGOs), Agricultural Extension Services, Legal Aid Clinics, Government Programs, Farmers' Associations and Cooperatives, Online Resources and Forums, or Community Networking can provide valuable support and guidance.

Building partnerships and investments is another crucial step. Farmers should seek investors and business partners or consult with business management consultants. Building strong relationships can provide the capital and expertise needed to grow and innovate.

Finally, by obtaining a yield that meets the needs of the community, one can ensure that the system produces enough not only to sustain the farm as a viable business but also contributes to both local needs and broader economic stability.

b. Improving Production

Improving production is essential for the success of your farming business, and it requires a multifaceted and thoughtful approach. It is recommended that you implement scientifically proven crop rotation techniques to break pest and disease cycles, enhance soil fertility, and boost crop yields. This method reduces the need for chemicals, leading to cost savings and increased income.

Consider intercropping and polyculture, planting different crops together to enrich your farm by enhancing biodiversity and promoting natural pest control. This practice builds resilient farming systems that can withstand various challenges.

Embrace Integrated Pest Management (IPM) methods for sustainable pest control without relying on harmful chemicals. Preserve the natural balance of your farm and protect the environment.

Maximize the utility of space and adopt modern farming techniques to achieve higher productivity without needing more land. Optimize what you have and make every part of the farm work efficiently. Consider agroforestry practices, integrating trees into farmland to improve soil quality, enhance biodiversity, and provide additional income sources.

Polyculture and crop diversity, rooted in indigenous wisdom, enhance soil health, control pests, and build resilience. Adapt these time-tested approaches to suit your local environment.

Integrate livestock into your farming system for more than an additional income stream. It contributes to pest control, soil fertility, and a balanced farm ecosystem, creating a more dynamic and self-sustaining environment.

Develop climate resilience and adapt your farming practices to suit specific local climates, making them inherently resilient to climatic variations. Understanding and working with the land, rather than against it, is key.

Lastly, carefully observe and interact with your local environment and ecosystem. Being in tune with the land, understanding its rhythms, and responding to its needs can lead to more harmonious and productive farming practices.

c. Boosting Income

In the dynamic world of farming, increasing your income becomes crucial to meet the challenges that may arise along the way. Start with diversification, growing different types of crops or integrating farming with livestock to reduce risks and provide multiple income streams. It's a way to build a safety net and open new doors for your farm.

Consider value addition by processing crops at a local level, such as milling grains, to add value and increase income. Functional packaging that ensures product safety and freshness can further enhance this strategy and extend shelf life.

Build a recognizable brand that establishes trust and attracts consumers with attractive, sustainable packaging, leading to premium pricing. Your brand represents a promise to customers, a statement of quality, and a means to stand out in the market.

Marketing is key to reaching your customers. Utilize various channels like social media, farmers' markets, and retailers to promote your products to targeted consumers. Direct marketing, such as selling directly to consumers at local markets, can eliminate intermediaries and enhance profit margins.

Certifications and geographical indications can further enhance your products. Organic or Fair-Trade Certification attracts conscious consumers willing to pay more for products that align with their values. Securing a Geographical Indication (GI) celebrates the unique qualities of your products, further enhancing their appeal in the market.

Incorporate technology in production, processing, and marketing to enhance efficiency and access new markets. It presents an opportunity to modernize your farm and reach a broader customer base beyond what was previously deemed feasible.

Build relationships with retailers or distributors who align with your product's value to boost sales. Finding partners in the business who believe in your product and can help reach a broader audience is essential.

Empower yourself by training and building capacity in business skills, processing techniques, marketing, and more. It's an investment in yourself and your ability to grow your business.

Finally, engage in farmers' markets, Community Supported Agriculture (CSA), or online sales to provide more direct consumer connections. These channels offer a way to foster relationships between you and your customers and keep more of the profits for yourself.

d. Farming Sustainably

Sustainability in farming demands a holistic approach that encompasses the environment, community, market, and future. By adopting these strategies, you can create a farming system that is productive, resilient, ethical, and in harmony with the world.

Investing in the future involves not only financial planning but also providing your crew with training and education to understand their role in maintaining quality. Documenting and tracking all agribusiness factors allow for proper intervention measures to keep your farm thriving.

Processing plays a vital role in sustainability. Primary processing, such as cleaning and grading, enhances shelf life and marketability. Secondary processing transforms agricultural products into value-added goods like jams, juices, or dairy products. Tertiary processing creates ready-to-eat foods, further increasing product value.

Embrace renewable energy sources like solar for water pumping to align with a sustainable vision for your farm.

Tap into the wisdom of traditional farming practices and indigenous knowledge, tailored to your local environment. By documenting and integrating these practices into educational programs, you can preserve and benefit from generations of wisdom. Learning from elders and combining traditional and modern practices can lead to innovative and maintainable farming solutions.

e. Utilizing Technology

In the rapidly evolving field of agriculture, technology has become an indispensable ally. Precision Agriculture is a cornerstone of modern farming. With GPS technology, you can map fields, monitor crop yield, and manage the application of fertilizers, pesticides, and water with pinpoint accuracy. Drones provide detailed aerial imagery to monitor crop health and growth, detect diseases, and analyze soil conditions. This precision not only enhances efficiency but also conserves resources.

Automation and Robotics bring a new level of efficiency to farming. Automated machinery like tractors and harvesters can perform tasks like plowing, planting, and harvesting more efficiently. Robotic arms used for sorting and packing produce safe labor and time, allowing you to focus on other essential aspects of the farm.

Irrigation Management has been revolutionized by smart irrigation systems. Sensors that monitor soil moisture levels and weather conditions provide precise water application, conserving water and ensuring optimal growth.

Greenhouse and Vertical Farming Technology offer control and innovation. Automated climate control systems in greenhouses regulate temperature, humidity, and light. Vertical farming and hydroponics allow for the cultivation of crops in vertically stacked layers or vertically inclined surfaces, maximizing space and resources.

Data Analytics and Farm Management Software empower farmers to make informed decisions. Collecting data on soil, weather, and crops and utilizing machine learning algorithms can predict potential diseases or pest infestations. Farm management applications help manage daily tasks, finances, inventory, and even compliance with regulatory requirements.

Livestock Monitoring has been enhanced through wearable devices that provide real-time monitoring of health, movement, and feeding patterns. It's a way to ensure animal well-being and optimal production through constant oversight.

Supply Chain and Marketing have been transformed by e-marketplaces and blockchain technology. Connecting directly with consumers or vendors gets better prices and reduces middlemen, while blockchain ensures traceability and transparency, providing consumers with information about the origin and quality of products.

Renewable Energy Technologies like solar and wind energy can power farm operations, reducing reliance on conventional energy sources and lowering costs. It's a sustainable approach that aligns with the future of farming.

Biotechnology offers opportunities like genetic engineering to develop crops resistant to pests, diseases, and extreme weather conditions, improving yields. The essence lies in leveraging scientific innovations to surmount some of the most crucial challenges in agriculture.

Mobile technology seamlessly integrates farming into the convenience of your hand, empowering you with real-time access and information at your fingertips. Mobile applications meticulously designed for farmers provide seamless access to essential information, including market prices, weather forecasts, and valuable agricultural advice, right at their fingertips.

Remote Sensing Technology, such as satellite imagery, can be used for large-scale monitoring of crop health, soil quality, and weather impacts. It's a bird's-eye view that offers insights and oversight on a grand scale.

Finally, utilizing social media and other online platforms allows you to share knowledge, market products, and build a supportive community. It's a way to connect, learn, and grow in a digital age.

f. Being Innovative

Innovation is more than just a tool; it represents a mindset. It entails a forward-thinking approach to the land, crops, and community, perceiving not only the present reality but also the untapped possibilities for the future. Farmers have the opportunity to be pioneers, innovators, and stewards of both tradition and progress.

One path to innovation is through the design of farms based on permaculture principles. This approach creates self-sustaining ecosystems that are resilient and productive. It involves collaborating with nature, and fostering a farm that flourishes as a vibrant and interconnected ecosystem. Permaculture is more than a mere method; it embodies a guiding philosophy that influences every aspect of farming, promoting a harmonious and sustainable approach.

Personalizing Nutrition-Based Agriculture is another frontier of innovation. Cultivating crops that address the personalized nutrition requirements of distinct community members or customers establishes a profound link between farming and the well-being of the people served. This approach acknowledges that food is not solely fuel; it embodies medicine, connection, and culture. Prioritizing the specific nutritional needs of the community enables the creation of a farm that nurtures at a fundamental level.

Farm tourism and educational workshops offer a way to share the magic of farming with others. Offering farm tourism or educational workshops can provide additional income and foster a greater understanding and appreciation of agriculture among the public. It's an opportunity to open the gates of your farm and invite people in, to share the knowledge, the challenges, the beauty, and the complexity of farming. Whether it's a hands-on workshop on organic gardening or a farm-to-table culinary experience, these offerings create connections between the farm and the community.

Innovation can also come from unexpected places. Perhaps it's a new way to engage with local schools, offering field trips and educational programs that connect children to the land. Maybe it's a collaboration with local artists, turning the farm into a canvas for creativity and expression. Or it could be a partnership with local healthcare providers, exploring the therapeutic benefits of farming and nature.

Being innovative is about being open, curious, and courageous. It's about asking questions, trying new things, and seeing the possibilities.

In your hands, the farm is not just a place to grow food; it's a place to grow ideas, relationships, community, and a future that is nourishing, sustainable, and vibrant. It's a place where tradition meets innovation, where the wisdom of the land meets the curiosity of the mind, where the farmer is not just a grower but a visionary, an innovator, and a leader.

g. Prioritizing Quality over Quantity

As a farmer, you have the opportunity to elevate your practice by emphasizing quality over quantity, recognizing that the true value of farming lies not just in what you produce but how you produce it. Embrace the uniqueness of your land, soil, weather, and natural resources, utilizing them to your advantage, understanding that quality begins with the very essence of the place where you farm. Adopt organic farming practices that invest in proper cultivation techniques, soil management, and irrigation practices to align with the natural rhythms and resources of your land. Moreover, continuous education and training are vital; even without formal institutions, you can form local learning groups, invite experts, and use online resources to foster a culture of excellence, empowering every member of your farm team to contribute to quality.

Quality Control Practices form the foundation of a quality-first approach in farming. Implement simple quality control practices to improve the overall quality of your products. Develop clear, written quality standards for your products to ensure consistency. Understand and adhere to international and local regulations to facilitate trade and ensure consumer safety.

Leverage technology, like sensors or digital tracking, for real-time monitoring to ensure adherence to quality standards. Regularly clean and sanitize your equipment, storage areas, and handling practices to prevent contamination and spoilage. Use laboratory testing to analyze nutritional content, contaminants, and other factors. Evaluate and manage supplier quality to align with your overall quality goals.

Create a culture that continually seeks to improve quality through regular reviews, updates, and innovations. Pursue quality certifications from recognized bodies to provide assurance to your customers and access premium markets. Implement environmentally sustainable practices to reflect the values of conscious consumers.

Invest in high-quality seeds, fertilizers, and pest management methods to ensure a strong foundation. Properly handle harvesting, post-harvest practices, and storage to maintain quality throughout the production process. Seek certifications and accreditations to validate the quality of your products. Establish partnerships with quality-conscious buyers and distributors to align your farm with others who share your commitment to excellence.

Comply with regulations, such as the "Maximum Residue Limit for Pesticides in Food and Agricultural Products." Stay updated and adhere to additional standards or protocols set by relevant ministries and institutions to ensure that you are aligned with the best practices in the industry.

Regularly inspect and monitor your farm at different stages of production, processing, and packaging to identify and rectify any quality issues early. Keep detailed records for traceability and accountability. Gather customer feedback to gain insights into quality improvement.

Ensure water and soil quality through testing and certification to support the overall quality of your products. Follow safe farming practices and apply self-regulation and responsiveness to feedback to create a system that is not only committed to quality but continually strives to achieve it.

Remember, quality is not just a measure of a product; it's a reflection of your values, your integrity, and your way of farming that honors the land, the community, the consumer, and the future.

h. Thinking Local

As farmers, you play a major role in your local community, and being a part of the local fabric goes beyond just a strategy; it's a way of farming that recognizes the importance of reciprocity. You understand that you can't receive without giving back, and this forms a cycle of life, economy, and loyalty that sustains your community.

Start by utilizing the wealth of local resources available to you. Embrace the use of local seeds and organic methods, not only for potential cost savings but also because it goes deeper than that. Relying on local and indigenous varieties of crops and livestock that are naturally adapted to your environment enhances your farm's resilience. It shows your commitment to honoring the inherent wisdom of the land, acknowledging that what thrives here is genuinely suited to this unique environment. By doing so, you contribute to preserving local biodiversity and cultural heritage, fostering a harmonious relationship between your farm and the land it resides upon.

Citizen Science and Experimentation offer a way to deepen your connection to the land and the community. You can conduct your own experiments, track data, and participate in citizen science projects to understand what works best in your particular context. It's about being a scientist, an explorer, a learner, always seeking to understand and adapt.

Farmers understand that local labor is not just a workforce; it represents a revitalization of agriculture and the economy. Prioritizing job opportunities for local residents and avoiding recruiting foreign labor is not just a matter of good business; it's an essential aspect of sustainability and good citizenship. You recognize that every role on your farm supports families, employs neighbors, and contributes to the overall strength of your community.

Community engagement is a vital part of your farming practice, extending beyond the farm gate. You believe in involving the community in design, decision-making, and resource-sharing, acknowledging that your farm is not an isolated island; it's an integral part of the larger community. Through collaboration, connection, and shared stewardship of the land, you actively contribute to the well-being of the community.

You also recognize the benefits of joining cooperatives and taking advantage of available programs. By doing so, you can benefit from the unity and support of your peers, understanding that as a farmer, you are not alone. There are valuable resources, support, and wisdom within the community that can help you thrive.

Thinking local goes beyond just farming; it's about being a part of something bigger, rooted, and interconnected. Your farm is not just about growing food; it plays a role in fostering community, relationships, trust, and a future that goes beyond mere sustainability. It nourishes at the core, providing more than just sustenance but a sense of pride and purpose for the entire community.

In conclusion, embracing a mindset of thinking local, farming local, and being local is not only a path that honors the land but also respects and uplifts the people and community around you, becoming a source of collective pride and progress.

i. Adopting Eco-friendly Practices

You know that your revenue comes from the land, the earth, and nature. It's crucial to be good to that which is good to us. You embrace a farming approach that goes beyond just growing crops but focuses on cultivating a future in harmony with the earth. You recognize that the land is not just a resource; it's a living, breathing entity that has its own wisdom, its own needs, and its own gifts.

An Ethical Foundation guides this way of farming. Care for the Earth ensures that all life systems continue to regenerate and flourish. Care for People provides for people's needs without undermining the needs of others. Fair Share recognizes limits and redistributes surplus to fulfill the first two ethics. Produce No Waste designs systems that recycle waste into resources. Design from Patterns to Details recognizes and utilizes natural patterns in the design. Integrate Rather Than Segregate creates synergies between different elements of the system.

Incorporating sustainable or socially responsible practices is not just about farming; it's about aligning farming practices with the values and expectations of those who consume the products.

Farm eco-friendly. Farm with wisdom, with respect. Farm in a way that honors not just the land but the community that consumes it.

In summary, to enhance agriculture and farming practices, farmers should adopt a mindset of continuous improvement, embracing the ethos of evolution. One crucial aspect of this approach is participating in research and development. By collaborating with local universities, NGOs, or private companies for research, you can stay updated on the latest advancements in agricultural science and technology. This fosters innovation and adaptation to specific challenges, empowering you to adopt cutting-edge practices that improve yields and sustainability.

Moreover, being open to change and using it creatively is essential. Embrace new ideas and methods, whether it involves adopting innovative farming techniques, exploring different crop varieties, or diversifying your products. By being adaptable, you can navigate evolving conditions and seize new opportunities, ensuring your long-term success.

Another key element is the application of self-regulation and acceptance of feedback. By creating self-regulating systems that are responsive to feedback, you can continuously monitor and assess your practices. This allows you to identify areas for improvement and make necessary adjustments to ensure optimal outcomes. This level of scrutiny and responsiveness supports sustainable and responsible farming practices.

By implementing these principles, you can optimize your agricultural operations, leading to increased productivity, resource efficiency, and environmental stewardship. In return, society benefits from a thriving agricultural sector that provides abundant and high-quality food while minimizing its ecological footprint. The collaboration between farmers, researchers, and the community fosters a positive cycle of progress, ensuring a brighter future for agriculture and society as a whole.

2. Cooperatives and Collective Efforts

In a landscape marked by economic instability and governmental challenges, collective farming emerges as a resilient solution. Collaboration through cooperatives and community-based organizations guides efforts to enhance quality, productivity, and income, bolstering farmers against adversity. Clear guidelines within cooperatives emphasize environmental stewardship and neighborly respect, addressing soil management, pest control, water conservation, and shared resources. Recognizing the interconnected nature of agriculture, ethical principles foster a culture of excellence and responsibility.

This segment delves into the broader impact of farming decisions, emphasizing the significance of hygiene and disease prevention for the entire farming ecosystem. Cooperation and shared responsibility foster a collective response to challenges, securing the community's well-being.

a. Improving Production and Quality

Cooperatives play a crucial role in promoting cost-effectiveness and improved access to essential resources by enabling farmers to purchase seeds and fertilizers in bulk at more affordable prices, promoting cost-effectiveness and improved access to essential resources. Collaborative sharing of expensive equipment among farmers empowers small-scale farmers to access advanced technologies that would otherwise be financially challenging for them to afford independently. Additionally, cooperatives should organize training and education sessions, equipping farmers with updated knowledge and best practices to enhance overall farming efficiency and productivity.

b. Enhancing Income

Collective bargaining empowers farmers to negotiate better prices and favorable market terms with buyers, strengthening their income prospects. Cooperatives serve as a powerful platform to help farmers explore new markets, both locally and internationally, unlocking opportunities for increased revenue streams. Moreover, by pooling resources, cooperatives facilitate farmers' access to credit at reasonable rates, supporting investments in their ventures and fostering long-term growth.

c. Providing Social Support and Security

Cooperatives can introduce health and insurance schemes to support farmers, providing them with much-needed protection. Additionally, they can act as neutral bodies in dispute resolution, facilitating fair resolutions among farmers and other stakeholders.

d. Developing Branding and Certification

Cooperatives can play a pivotal role in fostering the development of local brands or certifications, such as organic labels, to establish trust and enhance the perceived value of their agricultural products.

e. Investing in Technology and Infrastructure

Building or facilitating access to storage, processing facilities, or transportation can add value to products and reduce post-harvest losses.

f. Engaging in Policy Advocacy

Organized groups can engage in advocacy to influence local or national policies, ensuring that the needs of small-scale farmers are addressed.

g. Creating Emergency Funds

Cooperatives can create funds to support members during natural disasters or unexpected economic downturns, offering a safety net.

h. Promoting Gender Equality

Encouraging the participation of women and providing them with leadership roles can lead to more balanced and effective cooperatives.

i. Implementing Peer-to-Peer Lending Models

Seasoned and successful investor farmers are highly recommended as ideal partners. Their deep understanding of the agricultural business, recognition of quality practices, and invaluable expertise make them valuable consultants and collaborators at various levels. Their investment can be instrumental in driving growth and excellence in farming endeavors.

j. Incorporating Arts and Culture

Collaborating with artists and cultural practitioners can help celebrate agricultural heritage, boost morale, and even provide new marketing avenues.

k. Developing Agroecology Schools

Creating educational institutions dedicated to agroecology, offering hands-on experience and research opportunities.

l. Virtual Reality and Augmented Reality Trainings

Leveraging VR and AR for immersive training and skill development, especially in complex agricultural techniques.

m. Shared Transport and Fixed Fee for Fixed Services

Cooperatives can facilitate shared transport services and negotiate fixed fees for essential services, such as experts in business and agriculture, insurance, storage, testing, access to information, access to the agri-library, area quota in markets, legal, accounting, finance, audit, design, and marketing. Encouraging farmers to adopt a business-like approach through feasibility studies, cooperatives can collaborate with organizations to support the employment of local labor in agriculture. Additionally, aligning workforce planning with economic demands maximizes job opportunities for Lebanese employees. Encouraging collaboration and networking among women in the sector fosters sharing experiences and accessing resources. Moreover, involving women in decision-making and leadership roles within agricultural organizations recognizes and leverages their unique strengths to drive innovation and sustainability in agriculture. Lastly, knowledge sharing among farmers promotes learning from one another.

3. Collaborations and Partnerships

Both individual farmers and cooperatives can maximize their impact through strategic collaborations and partnerships. By working together with various stakeholders, farmers can access valuable resources, expertise, and market opportunities that can drive agricultural growth and sustainability.

a. Partnering with Educational Institutions

Collaborating with universities or vocational schools can bring scientific expertise, research opportunities, and specialized training programs to farmers. This partnership fosters knowledge exchange, empowering farmers with the latest agricultural advancements and techniques.

b. Working with the Private Sector

Strategic partnerships with businesses can lead to innovation, investment, and expanded market access for farmers. By teaming up with the private sector, farmers can explore new marketing channels, distribution networks, and value-added opportunities.

c. Engaging with International Organizations

Collaborating with international agricultural organizations provides farmers with access to funding, cutting-edge technology, and global best practices. This global exchange of knowledge enhances the resilience and competitiveness of local agriculture.

d. Networking with Other Cooperatives

Forming networks or federations with other cooperatives amplifies farmers' collective bargaining power and facilitates knowledge sharing. Collaborating on larger projects and joint initiatives enables farmers to tackle common challenges and seize opportunities together.

e. Collaboration with Local Communities

Working closely with local communities builds trust, social cohesion, and ensures that farming practices align with community needs and values. This collaborative approach enhances social acceptance and support for agricultural activities.

f. International Partnerships and Exchange Programs

Engaging in international partnerships and farmer exchange programs facilitates the sharing of knowledge and best practices across borders. This global perspective enriches local farming practices and fosters cross-cultural learning.

g. Fostering Social and Cultural Connections

Organizing social events, festivals, or cultural programs fosters a sense of community and shared purpose among farmers. Celebrating agricultural heritage strengthens the bond between farmers and society.

h. Building Cross-Sector Collaborations

Forming partnerships with non-agricultural sectors such as tourism, technology, and healthcare creates synergies and opens new opportunities. These collaborations bring fresh ideas, investments, and diversified income streams to the agricultural sector.

i. Farming Strategies

In an ever-changing landscape, the collaboration of farmers through cooperatives and community-based organizations offers a path to agricultural success. This section presents a range of overarching and visionary strategies designed to enhance farming practices, promote sustainability, and ensure resilience in the face of challenges. From fostering inclusive governance models to embracing cutting-edge technologies, these strategies aim to empower farmers to create a prosperous and interconnected farming community that thrives in a dynamic environment.

- Sustainability: Cooperatives play a crucial role in community resource management, ensuring sustainable usage of local resources such as water bodies and forests. By fostering collaborative efforts, cooperatives can ensure the sustainable and responsible usage of these valuable resources for the benefit of the entire community. Additionally, cooperatives can be instrumental in promoting and advancing environmentally sustainable practices among their members. Through educational initiatives and incentive programs, cooperatives encourage farmers to adopt eco-friendly methods that protect the environment and contribute to the long-term health of the ecosystem.
- Community Governance Models: Developing transparent and democratic governance models within cooperatives and community organizations can build trust and efficacy. Involving all stakeholders in decision-making processes ensures that the interests and needs of the community are well-represented.
- Inclusion of Marginalized Communities: Actively including marginalized groups such as indigenous communities, ethnic minorities, or disabled individuals can foster a more robust and equitable agricultural system. Embracing diversity and providing equal opportunities can lead to a more inclusive and resilient farming community.
- Climate Change Adaptation and Mitigation: Implementing climate-smart agricultural practices and participating in local climate change planning can help farmers adapt to and mitigate the effects of climate change. Taking proactive measures to address environmental challenges ensures the long-term viability of agricultural activities.
- Holistic Ecosystem Management: Embracing a holistic view that includes wildlife conservation, watershed management, and landscape planning can lead to a more balanced and resilient farming ecosystem. By understanding and respecting the interconnectedness of nature, farmers can create thriving ecosystems that benefit all life forms.
- Regional and Global Farmer Networks: Building expansive networks that allow for knowledge exchange, collaboration, and solidarity across vast geographical areas can amplify farmers' voices and foster global agricultural partnerships.
- Creating Agricultural Commons: Establishing shared agricultural commons, governed by communities, to steward land, water, and biodiversity collectively ensures sustainable and community-driven land management practices.
- Bioregional Planning: Embracing bioregional planning that aligns agriculture with the natural ecosystems, culture, and economy of a region can promote localized and resilient farming systems.
- Social Impact Bonds and Investment: Collaborating with social impact investors to finance transformative projects that align with social and environmental goals can boost innovative initiatives in agriculture.
- Community Science and Open-source Technology: Creating platforms for community-driven scientific research and open-source technology empowers farmers to innovate without corporate dependency and fosters collective knowledge sharing.
- Integrating Agriculture with Health and Well-being: Building models that tightly integrate agriculture with community health initiatives, nutritional programs, and mental well-being ensures holistic and sustainable development in farming communities.

The roadmap for your prosperous Lebanese agricultural future underscores your vital roles as individual farmers, cooperative

participants, collaborators, and visionaries. This segment acknowledges the challenges you face and offers comprehensive guidance to navigate these obstacles while seizing opportunities.

Through your adoption of innovative approaches, refinement of production techniques, expansion of income streams, commitment to sustainability, and harnessing the potential of technology, you can elevate your practices and contribute to a vibrant agricultural sector. The collaborative essence of cooperatives and the strength of partnerships further amplify your endeavors, fostering innovation and ensuring a competitive and responsible agricultural industry.

As you embark on this collective journey, you lay the cornerstone for a lasting legacy that benefits both the land and the communities it supports. United in purpose, you forge a path toward a brighter and more sustainable agricultural future.

C. Society

With the current limited involvement of the government in Lebanon, there arises a growing need for proactive engagement from the society. Rather than relying solely on governmental initiatives, different sectors in society have the opportunity to assume responsibility and make meaningful contributions to the agricultural sector.

Although the following recommendations are categorized by societal divisions, it is important to emphasize that all sectors can act upon these recommendations. The categorization merely suggests which sector might be best positioned to lead certain initiatives especially when it's in within their practical expertise, and they are positioned to benefit from this "social entrepreneurship" or "cause-related marketing". However, collaboration across all sectors within society is strongly encouraged, acknowledging that the collective effort and synergy generated through such collaboration can result in the most profound and far-reaching impact.

1. Academic, Technical, and Research Institutions

Academic, technical, and research institutions are uniquely positioned to reshape perceptions about agriculture and equip future generations with the necessary knowledge and skills to advance the sector.

Below are several recommendations outlining the areas where these institutions can actively engage and produce a meaningful impact.

a. Awareness Campaigns to Destigmatize Farming

Education, technical, and research institutions hold a unique power to shift societal attitudes toward agriculture since farming is perceived as a less attractive career path. By launching comprehensive awareness campaigns, these institutions can showcase the importance and value of farming in society, emphasizing the intellectual stimulation and technological advancement inherent in modern agriculture.

Utilizing the reach and impact of social and traditional media, these campaigns can involve success stories and interactions with successful professionals in the field. Engaging experts in lectures and workshops, from various sub-fields of agriculture such as soil science, agricultural engineering, and agripreneurship can help challenge misconceptions and highlight the intellectual challenges and potential in agriculture.

In this endeavor, collaboration with NGOs, with their on-ground experience and connections, can provide valuable insights into addressing people's concerns and reaching out to the wider community. They can also facilitate connections with international organizations interested in agricultural development, opening up avenues for collaboration and funding.

Furthermore, local stakeholders in the agri-business sector can play an important role by sponsoring these campaigns. Their support does not only contribute to the overall promotion of the agricultural sector but also benefits their businesses by creating a more informed and appreciative consumer base. This symbiotic relationship can help create a sustainable and supportive environment for the growth of agriculture.

b. Promoting Gender Equality

Academic, technical, and research institutions hold a unique position to advocate for gender equality within the agricultural sector. This can involve several proactive measures, such as:

- Spotlighting Women's agri-achievements: Sharing success stories of accomplished women in agriculture through various media channels, such as websites, magazines, social media, and conferences. This will not only inspire other women but also challenge the existing gender stereotypes in agriculture.
- Support and Resources: Providing targeted resources and support for female students in agriculture-related programs, such as mentorship programs, networking opportunities, and access to gender-sensitive counseling and career advice.
- Research on Gender Equality Benefits: Conducting and promoting research on the multifaceted benefits of gender equality in the agricultural sector, including increased productivity, enhanced sustainability, and improved food security.
- Gender-Balanced Grant Allocation Policy: Instituting an equitable grant distribution policy can also play a pivotal role in promoting gender equality. By reserving an equal number of grants for female applicants, educational institutions can ensure that financial constraints do not become an additional barrier for women aspiring to enter or excel in this field. This policy should be communicated clearly and executed transparently, emphasizing the institution's commitment to promoting gender parity and recognizing the critical role of women in agriculture's future.

c. Highlighting Business Opportunities

Academic institutions can also work on raising awareness about the myriad of business opportunities in the agricultural sector. This might involve offering courses on agripreneurship, inviting successful agri-business owners to share their experiences, and publishing research on the profitability and growth potential of various agri-businesses.

d. Research and Development (R&D)

Universities and research institutions should spearhead innovative R&D initiatives in sustainable farming methods, crop yield improvement, and pest/disease management. They can also work on the development and propagation of drought-resistant and climate-resilient crop varieties.

e. Education

- Expanding Agricultural Knowledge: Academic, technical, and research institutions are well-equipped to expand society's knowledge about the significance and scope of agriculture. They should focus on delivering and promoting agricultural education in a manner that combines both theoretical understanding and practical skills. Moreover, by revising curricula periodically, these institutions would ensure that agricultural education remains relevant and aligned with the evolving demands of the field, on a national and international level. Agriculture-related courses should be more integrated into the curriculum, with a particular focus on sustainable and regenerative agriculture, agroecology, farm management, and agricultural economics. Practical, hands-on training programs should be designed for interested individuals.
- Integrated Agricultural Education: To tackle modern agricultural challenges, solutions need to be approached from various perspectives. Universities can create interdisciplinary programs combining agriculture with other fields such as data science, business, environmental science, and policy-making. Such comprehensive programs can equip future agricultural leaders with the necessary knowledge and skills to effectively manage and improve the sector. Institutions can work towards incorporating various relevant disciplines into agricultural education. In practice, Universities and technical institutes would incorporate agricultural and farming-related topics into a broader range of disciplines, including environmental studies, business, economics, and public health. They can offer courses that explore agricultural policy, agricultural law, and the political dimensions of food systems, and abroad programs that explore international agriculture, global food systems, and agricultural development in different regions. This can include business management, financial literacy, and feasibility studies. A particular focus on sustainable and regenerative agriculture, agroecology, farm management, and agricultural economics is also recommended. Practically, hands-on training programs should be designed for interested individuals. By doing so, students can gain a more holistic understanding of the sector and be better prepared to handle real-world challenges.

f. Training

- Comprehensive Training Programs: Academic, technical and research institutions should conduct Regular training sessions and seminars that play a critical role in agriculture-related education. These programs provide participants with opportunities to expand their knowledge base, refine their skills, and stay updated with emerging trends and technologies in the agriculture sector. Topics covered may include sustainable farming practices, pest and disease management, soil health, crop rotation, and the use of technology in farming. These sessions cater not only to students and academics but also to farmers, agri-business owners, and other stakeholders in the agriculture sector.
- Diverse Topics and Target Audience: Training programs address a wide range of relevant subjects, targeting different audiences within the agriculture sector. The topics covered may include innovative farming techniques, market trends, financial management, supply chain management, and more. By tailoring the training to specific roles and responsibilities, participants gain valuable insights and practical knowledge that align with their needs.
- Seminars for Discussion and Exposure: Seminars provide a platform for interactive discussions, sharing experiences, and exposure to various aspects of agriculture. They often feature guest speakers from different fields, including successful farmers, agricultural scientists, policymakers, agripreneurs, and international experts. These seminars foster an exchange of ideas and encourage critical thinking, leading to innovative solutions for sector challenges. Networking opportunities during seminars contribute to the professional development of participants.
- Mixed Delivery Methods: Training sessions and seminars are recommended to be conducted through a combination of physical and virtual methods. This flexibility ensures accessibility for a broader audience, regardless of geographical location or scheduling constraints. Virtual sessions allow remote participation, making it more convenient for individuals to join. Additionally, resources and materials from these sessions can be made available online for future reference, enabling continuous learning and self-paced development.

g. Policy Research and Recommendations

- Policy Analysis and Evaluation: Academic, technical, and research institutions play a vital role in shaping agricultural policy through rigorous research and evidence-based recommendations. Leveraging their neutrality and research expertise, these institutions can conduct in-depth analyses of existing agricultural policies. By examining the strengths, weaknesses, and areas of opportunity in these policies, valuable insights can be gained. This analysis informs the development of comprehensive and well-informed recommendations for policy improvement.

- Evidence-Based Recommendations: The insights and findings from policy analyses serve as the foundation for evidence-based recommendations. Academic, technical, and research institutions can utilize their expertise to propose actionable recommendations that address various aspects of agricultural policy. These recommendations may focus on improving resource allocation, supporting sustainable farming practices, encouraging technology adoption, and enhancing market access for small-scale farmers. By aligning recommendations with research evidence, these institutions ensure that their suggestions are grounded in thorough analysis and have the potential to drive positive change.

- Integration of Society into Quality Assurance and Accountability Mechanisms: Academic, technical, and research institutions can also propose policies that integrate society into quality assurance and accountability mechanisms in agriculture. This involves formulating guidelines for community-based monitoring of food quality, establishing public reporting mechanisms for agriculture-related concerns, and promoting citizen engagement in local agricultural decision-making processes. By involving the broader society, these policies ensure that quality standards are met, concerns are addressed, and decision-making processes become more inclusive and transparent.

- Utilization of Policy Papers: Policy papers from academic, technical, and research institutions serve as valuable resources for society. Advocacy groups, NGOs, and governments shall utilize these papers to drive policy reforms, guide interventions, and improve governance in agriculture. This contributes to creating an efficient, inclusive, and responsive agricultural sector that supports sustainable practices, equitable resource allocation, and enhanced market access. Academic and research institutions play a crucial role in advancing the sector through evidence-based recommendations, promoting growth, and addressing challenges.

h. Facilitating Connectivity

Institutions of academia and research play an important role in bridging the gap between education and industry. This involves creating opportunities for students and professionals to connect, learn, and progress in their careers. Such initiatives can include:

- Career Fairs: Regular hosting of agriculture-focused career fairs are recommended to provide students with the opportunity to engage directly with industry stakeholders. These events can expose students to a wide array of career paths in agriculture and its allied sectors, from farming and agri-business to agricultural technology and policy-making. They also offer agri-businesses a platform to showcase their operations, discuss potential job opportunities, and spot promising talent.

- Internship Programs: Establishing partnerships with agri-businesses and NGOs is suggested to offer internship programs provides a practical learning experience for students. This not only allows students to apply their academic knowledge but also gives them firsthand exposure to the realities of the workplace, thereby making them better prepared for future employment. Simultaneously, businesses benefit from the fresh ideas and perspectives that interns bring to the table.

- Networking Platform: The development of an online networking platform is recommended to foster greater collaboration and knowledge sharing among students, researchers, professionals, and businesses in the agricultural sector. Such a platform can facilitate mentorship opportunities, promote research collaborations, disseminate job opportunities, and enable the sharing of resources and knowledge.

- Incentivizing Innovation: Academic, technical and research institutions should facilitate agriculture-focused innovation competitions and challenges, encouraging students to demonstrate their creative solutions. These events foster healthy competition, ignite innovation, and acknowledge exceptional ideas capable of transforming the agricultural sector. Research and innovation grants specifically allocated for agricultural projects offer financial support and incentivize students to explore and experiment with creative concepts. This support enables students to bring their innovative ideas to fruition, making a tangible impact on the sector. Networking opportunities facilitate the transformation of innovative concepts into practical projects or agricultural-focused start-ups. Establishing platforms for students to share their innovative ideas, research findings, and agricultural projects cultivates a collaborative environment where ideas can be exchanged and further developed.

i. Laboratory Services

- Testing Services for Agricultural Produce and Materials: Academic, technical and research institutions should provide testing services for agricultural produce and materials. These services cover a wide range of testing needs, including soil fertility assessment, identification of plant diseases, evaluation of food safety standards, and analysis of nutritional content. By providing these services, institutions contribute to ensuring the safety, quality, and productivity of local agricultural products.

- Experiential Learning Opportunities for Students: It is recommended that academic, technical and research institutions provide experiential opportunities for students such as field visits and hands-on projects. This hands-on experience enhances their practical skills, fosters critical thinking, and deepens their understanding of the complexities and challenges faced in the agricultural sector. Students gain valuable insights into the application of scientific principles and develop problem-solving abilities.
- Contribution to Societal Well-being and Economic Development: By offering access to reliable testing, these institutions ensure the safety, quality, and compliance of local agricultural products with regulatory standards. Evidence-based farming practices are promoted, enabling farmers and agri-businesses to make informed decisions. Through access to accurate testing information, farmers and businesses can optimize their production processes, enhance market competitiveness, and meet consumer demands, ultimately supporting the growth of the agricultural sector.
- Strengthening Academia-Society Linkages: By actively involving the community, educational and research institutions reinforce their commitment to improving the agricultural sector. Through these programs, institutions collaborate with farmers, agri-businesses, and community groups, fostering knowledge exchange, sharing expertise, and addressing shared challenges.

j. Merit-Based Consultation Initiatives

- Free Consultation Services: Academic, technical, and research institutions should offer free consultation services to the agricultural sector, leveraging their knowledge and expertise. These services are designed to assist farmers, agri-businesses, and community groups in addressing real-world challenges. Talented students, particularly those at the master's level and above, have the opportunity to apply their academic knowledge to practical agricultural problems. In collaboration with leading industry professionals and researchers, these institutions provide specialized consultation in two key areas.
- Agricultural Consultation: Institutions should provide valuable advice on sustainable farming practices, crop rotation strategies, integrated pest management, water conservation, soil health maintenance, precision farming techniques, and the implementation of advanced agricultural technologies. Farmers and agri-businesses can benefit from expert guidance tailored to their specific needs, enabling them to improve productivity, optimize resource utilization, and adopt environmentally friendly practices.
- Business Consultation: Institutions should also offer business consultations for beginning farmers and agri-businesses. This aspect of the program focuses on supporting the beneficiaries in developing robust business plans, conducting feasibility studies, exploring market opportunities, optimizing supply chain operations, and enhancing financial management strategies. By accessing specialized guidance, stakeholders can make informed decisions, enhance operational efficiency, and foster sustainable growth in the agricultural sector.
- Reciprocal Benefits for Educational Institutions: Engaging in tangible societal challenges offers reciprocal benefits for educational institutions, reinforcing their commitment to education and societal advancement.
- Collaboration and Partnerships: Academia and research institutions understand the importance of cross-sector collaborations and partnerships in maximizing the impact on the agricultural sector. By partnering with diverse stakeholders such as media outlets, advocacy groups, non-governmental organizations (NGOs), and agri-businesses, they can foster innovation, disseminate knowledge, and implement effective solutions. Media collaboration amplifies research reach and impact, bridging the gap between academic knowledge and the wider public. Working with advocacy groups, these institutions utilize their research findings to influence policy changes, promoting sustainable agricultural practices and addressing systemic challenges. Collaboration with NGOs translates academic initiatives into practical projects, effectively applying research outcomes in real-world contexts. Furthermore, research partnerships with agri-businesses promote knowledge exchange and the development of practical solutions to complex agricultural issues, translating scientific knowledge into tangible applications. To summarize, this society-engaged, collaborative approach allows academia and research institutions to enhance the agricultural sector while fortifying their role in societal development and transformation.

Successfully implementing all the aforementioned actions would not only benefit the agriculture sector and the numerous stakeholders involved, but would also prove advantageous for the academic, technical, and research institutions. As these steps lead to a better understanding and evolution of the sector, there would be an increased interest in the field, resulting in more students enrolling in related programs and fields. This, in turn, leads to financial and marketing gains for the institutions involved.

2. The Pervasive Influence of Media on Agriculture

The role of the media in society is pervasive and influential, impacting all sectors, including the agricultural sector. In the Lebanese context, where agriculture plays a critical role, local media carries a heightened responsibility. It serves as a powerful tool to facilitate the collaboration of different stakeholders, build resilience against various challenges, and mold public perceptions about agricultural practices, policies, and impact. By providing accurate, timely, and relevant information, local media plays a crucial role in safeguarding, and strengthening the agricultural sector, enabling it to navigate the complexities of modern-day farming and meet the demands of the market with resilience and success.

a. Disseminating Information

The dissemination of information plays a multifaceted role in the agricultural sector, with media outlets serving as vital conduits. They not only promote agricultural events, workshops, and seminars but also provide a wealth of information for farmers and the general public. Through regular broadcasting of updates on government initiatives, subsidies, and support programs, the media should ensure that all relevant stakeholders are well-informed about the opportunities and resources available to enhance their agricultural pursuits.

Furthermore, media outlets serve as essential hubs of information regarding local markets, agricultural fairs, and trade events. By keeping farmers abreast of market trends and facilitating access to potential opportunities, the media should help farmers make informed decisions for their agricultural businesses. However, it is imperative for the media to maintain a balanced representation of all agricultural sectors and trends, preventing any undue shift in focus that may inadvertently cause harm.

b. Sharing Knowledge

In addition to disseminating information, the media also plays a significant role in sharing knowledge within the agricultural sector. By featuring interviews with industry experts, media outlets provide valuable insights into market demands, consumer preferences, and emerging trends. This wealth of information empowers farmers to align their production strategies with evolving market needs, optimizing productivity and profitability.

Moreover, the media serves as a powerful catalyst for technological advancements in agriculture. By reporting on innovative practices and advancements, media outlets encourage the farming community to adopt transformative technologies, potentially revolutionizing their operations and increasing yields. The media's role in highlighting successful agricultural practices, as well as effective government policies, shall equip farmers with a broader understanding of the field, enabling them to adopt practices that improve sustainability and overall productivity.

c. Strategic Communication

Drawing on their communication prowess, media outlets can strategically shape the timing and framing of their reporting, resulting in a more influential and impactful message. By prioritizing the dissemination of information that affects farmers' profitability, media can directly influence the success of farming operations, and by their unique knowledge of the preferences of their viewers, can also optimize information reception by utilizing the many genres of communication in their arsenal, from animation, to relating reporting, they can make sure information, even complex policies, can be clearly comprehended by all ranges of stakeholders to the best ability.

The media is also in a unique position to provide comprehensive coverage and analysis of agricultural policies and programs. Detailed reporting can assist farmers in understanding the benefits, requirements, and application processes associated with these initiatives. This empowers farmers to fully utilize available resources and support, thereby overcoming challenges and enhancing their farming practices.

In promoting agricultural entrepreneurship, media outlets can profile local agribusinesses, spotlight farm-to-table initiatives, and highlight value-added agricultural products. These stories can inspire innovation and entrepreneurial thinking within the farming community, fostering a more vibrant and diverse agricultural sector.

d. Crisis Management

Crisis management is an area where the role of local media becomes highly significant. As a trusted source of information for farmers, media outlets have a responsibility to provide real-time updates on emerging crises, issue early warnings, and deliver guidance on necessary precautions and safety measures. By relaying information about imminent risks promptly and advising farmers on appropriate actions, the media can effectively help mitigate potential damages and protect invaluable agricultural assets. The media will be serving as a key player in ensuring that the agricultural community is well prepared and informed, capable of navigating challenging situations with minimal disruption to their operations.

e. Corporate Social Responsibility

As we delve deeper into the discussion, the media's dual role will be highlighted as both an informer and a societal advocate.

The media's Corporate Social Responsibility (CSR) encompasses more than just reporting news; it entails prioritizing reports that have a profound impact on the community. In the realm of agriculture, this would mean dedicating resources, including free slots, to cover agriculturally pertinent information and not just adhering to government-mandated reports. By doing so, media organizations can align their operational priorities with societal needs, reinforcing their crucial role in strengthening the agricultural sector.

f. Advocative Voice

As advocates, media platforms can amplify the voices of the farming community, helping articulate opinions and concerns. In doing so, the media would influence public awareness and shape agricultural policies to better address the needs of farmers. The media brings the challenges faced by farmers, such as access to resources, the impacts of climate change, and market fluctuations into public discourse, fostering attention and support.

Furthermore, by highlighting the importance of fair-trade practices and ethical sourcing, media plays a role in shaping a more transparent and equitable marketplace. This advocacy protects farmers' interests and fosters a more sustainable and ethical agricultural sector, contributing to the broader socio-economic development of Lebanon.

g. Investigation Force

Through in-depth investigative journalism, media platforms can serve as a potent force in uncovering systemic issues affecting the agricultural sector. They can highlight instances where certain policies or practices may be counterproductive or even harmful to farming communities. By doing so, they act as watchdogs, shedding light on these issues and promoting transparency and accountability in agricultural governance.

h. Inspiring Resilience

The media's role in building long-term resilience within agricultural communities is significant. This involves uncovering post-disaster recovery initiatives and featuring stories of farmers who have successfully rebounded from adversity. By showcasing these stories of collaboration and cooperative efforts, the media can provide a beacon of inspiration for others facing similar challenges. Furthermore, they offer practical guidance on best practices for rebuilding agricultural infrastructure, adopting climate-resilient practices, and enhancing preparedness for future challenges.

i. Ethical Responsibility

In fulfilling these varied roles, it is paramount for the media to maintain integrity and not succumb to the allure of disseminating false information for financial gain. It is essential for media outlets to resist the temptation to promote products or practices that are harmful, even if they do so indirectly or under the guise of paid publicity. This includes harmful agricultural-related products or practices, paralleling the way media avoids promoting harmful products such as cigarettes. Upholding this ethical standard is not just crucial for the trustworthiness of the media, but it also directly impacts the health and wellbeing of the agricultural sector and the society at large. Thus, maintaining a focus on accurate and responsible reporting is integral to the media's role in enhancing Lebanon's agricultural sector.

Assuming such a role is not only crucial and irreplaceable for the agricultural cycle but also provides media outlets with benefits, for it helps build a loyal audience base and fosters a dependent relationship, leading to increased viewership and improved returns on paid advertisements.

3. The Role of CSOs in Enhancing Agriculture

Civil society organizations (CSOs) form a diverse and multifaceted collective, encompassing NGOs, non-profits, advocacy groups, and regulatory initiatives. Operating independently from governments and businesses, they unite with the shared purpose of addressing social, environmental, and political issues to foster positive change and enhance the well-being of society.

These entities play a crucial and complementary role in the Lebanese agricultural sector by filling gaps and compensating for shortcomings that may exist within various entities, including governmental institutions, individuals, stakeholders, and academia, with a collective mission, contributing to the betterment of the society as a whole. These organizations bring a fresh perspective, innovative approaches, and a strong commitment to making a positive impact in agriculture.

One of the key strengths of NGOs is their ability to develop comprehensive plans and interventions that address critical issues and enhance agricultural practices with a deep understanding of the Lebanese context, and its' governmental conundrums. Unlike other entities, Lebanese NGOs' focus is expected to be solely on philanthropic purposes, ensuring that their initiatives are driven by the goal of improving the well-being of farmers, promoting sustainable agriculture, and fostering community development.

The following are a range of recommendations that NGOs are particularly well-positioned to implement.

a. Enhancing the System

CSOs play a crucial role in advocating for consumer rights and influencing policies in the agricultural sector.

- Access to Legal Support: CSOs should actively establish and promote avenues that enable consumers to seek legal advice or support in case their rights are violated. These channels should also facilitate the reporting of fraudulent or harmful products and practices, ensuring consumer protection and fostering a safe marketplace.
- Policy Recommendation: CSOs can be instrumental in shaping policies at various levels, including local, regional, and international. Their involvement in policy recommendation can be categorized as follows:
  - Local Level: At the local level, CSOs in Lebanon have a significant role to play in advocating for policies and implementing initiatives that promote sustainable agriculture and protect consumer rights.
  - Community Engagement: CSOs should identify and address the specific needs of local communities, recommending policies for sustainable agricultural development at the grassroots level.

- Support for Small Farmers: Advocate for policies providing substantial support to small farmers and local markets, fostering an environment conducive to sustainable agriculture.
- Consumer Protection: Be at the forefront of advocating for robust consumer protection laws, collaborating with regulatory bodies for efficient grievance reporting.
- Quality Assurance Procedures: Ensure food safety through rigorous quality assurance procedures, and establishing guidelines and standards that govern the production, processing, and distribution of food. These procedures include rigorous inspections, testing, and certification processes, while collaborating with stakeholders for compliance.
- Effective Complaint Systems: Advocate for efficient complaint systems with streamlined and transparent mechanisms within regulatory bodies to safeguard consumer rights.
- Enhancing Programs for Citizen Monitoring: Empower individuals with the qualifications and expertise to effectively monitor agricultural standards by providing comprehensive capacity-building programs, training and support covering safety protocols, sustainability measures, and quality assurance procedures, encompassing data collection, observation techniques, and documentation methods.
- Accountability Measures: Collaborate with authorities to create mechanisms that hold producers and stakeholders accountable for adhering to agricultural standards and regulations.
- Championing Sustainable Agriculture: monitor existing policies, analyze them to identify challenges and opportunities, advocate for necessary adjustments or improvements to ensure their effectiveness; Also, advocate for new policies promoting improved nutrition and sustainable agriculture, engaging in research, coalition building, and evidence-based policy development.
- Promote Food Access: Advocate for policies that ensure affordable and equitable access to nutritious food for all segments of the population.
- Legislative Advocacy: Lobby for the implementation of national laws and regulations that safeguard consumers' rights, foster sustainable agricultural practices, ensure food security, and support innovation in the agricultural sector.
- Aligning with Global Standards: Support the alignment of national policies with international agreements and standards, ensuring coherence and compliance on a global scale.

- Regional Level: At the regional level, CSOs have a vital role to play in promoting collaboration and sustainable development in the agricultural sector. They can achieve this through the following recommendations:
  - Cross-Border Collaboration: Actively facilitate collaboration between regions to address common agricultural challenges and opportunities, such as synthetic contamination, water management and pest control.
  - Regional Development: Advocate for regional development strategies that prioritize agricultural growth, environmental protection, exchange of expertise and resources, collaboration and socio-economic inclusion.
- International Level: The following are key recommendations for CSOs to promote positive changes in the agricultural sector at local and international levels.
  - Global Coordination: Collaborate with international organizations to harmonize agricultural policies across borders, addressing global challenges such as climate change and food scarcity.
  - Representation in International Fora: Represent the interests of their constituencies at international negotiations and agreements to ensure that global agricultural policies reflect diverse perspectives.

- Food Security: CSOs play a multifaceted role in ensuring food security, covering various aspects:
  - Identify Vulnerabilities: Conduct assessments to identify regions and populations at risk of food insecurity.
  - Monitor Food Availability: Actively monitor food supply, demand, and price trends to detect potential food security threats early.
  - Disaster Relief: Collaborate with governments and other agencies to establish effective mechanisms for providing immediate food assistance in emergencies.
  - Recovery Support: Participate in long-term recovery efforts by focusing on rebuilding agricultural infrastructure and restoring livelihoods.
  - Community-Based Solutions: Engage with communities to develop and implement localized solutions to food security challenges.
  - Empower Vulnerable Groups: Prioritize working with marginalized groups to enhance their capacity to produce or access food.
  - Research into Food Security Challenges: Conduct research to understand complex food security issues and develop innovative solutions.
  - Promote Agricultural Innovation: Foster innovation in agricultural techniques, technology, and practices to increase food availability and stability.
  - Watchdog Role: Tracking and assessing the enforcement of

these policies to ensure accountability and transparency in the agricultural sector.
    - Transparency Initiatives: Pushing for open access to governmental agricultural data and decision-making processes.

b. Supporting the Farmers

- Collaboration with Stakeholders: Collaborative efforts can foster transparency, ethical practices, and mutual respect within the entire supply chain. CSOs should actively engage with various stakeholders, including farmers, retailers, and governmental bodies, to foster transparency, ethical practices, and mutual respect within the entire agricultural supply chain.

- Provide Market Research: CSOs can support farmers by conducting market research and understanding consumer demand. This ensures interventions to improve agricultural quality are effective and beneficial and market access while avoiding potential negative impacts on farmers. Collaborating with farmers and stakeholders ensures a participatory approach, integrating their perspectives. By considering market trends and preferences, CSOs can develop holistic plans that enhance product quality and market access while being sustainable.

- Providing Consultations for Enhanced Agriculture Strategies: CSOs can enhance agriculture strategies through their expertise and specialists, offering valuable consultations to farmers, agricultural organizations, and government agencies. Their understanding of sustainable farming practices, resource management, and innovative technologies helps stakeholders optimize processes and achieve higher crop yield and quality.

- Educational Support and Training: CSOs can enhance agriculture through educational support and training. By equipping farmers with modern techniques, sustainable practices, and business skills, CSOs promote productivity, environmental stewardship, and profitability.
    - Skills Development: Provide training in modern farming techniques, sustainable practices, and new technologies to enhance productivity and environmental stewardship.
    - Business Skills: Offer education in business management, marketing, and financial planning to help farmers operate more efficiently and profitably.
    - Nutritional Education: Provide education on nutrition and healthy eating habits to promote quality production.

- Access to Resources: Ensuring farmers' access to critical resources is vital for agricultural development.
    - Seed and Equipment Distribution: Facilitate access to high-quality seeds, equipment, and other essential farming inputs to optimize productivity.
    - Credit and Financing: Help farmers access affordable credit and financing options, including grants, loans, and subsidies.

- Market Access and Value Chain Integration: Enhancing market access and value chain integration is crucial for farmers to thrive in today's agricultural landscape. CSOs can play a vital role in this area through the following recommendations:
    - Market Linkages: Assist farmers in connecting with markets, including local, regional, national, and international buyers.
    - Value Addition: Support initiatives that add value to agricultural products through processing, packaging, and branding.

- Advocacy and Legal Support: Providing legal assistance to farmers in land rights issues, contract negotiations, and other legal matters is a crucial aspect of supporting agricultural communities.

- Community Development and Social Support: Creating strong and resilient farming communities is vital for sustainable agriculture. CSOs can contribute significantly to this area by focusing on community building and promoting the health and well-being of farming communities.
    - Community Building: Foster a sense of community among farmers through cooperatives, associations, and networks that enable collaboration and shared resources.
    - Health and Well-being: Promote programs that address the overall health and well-being of farming communities, including mental health support.

- Sustainable Farming and Environmental Protection
    - Promoting Sustainable Practices: Incentivize and support the adoption of environmentally friendly farming practices.
    - Climate Resilience: Help farmers adapt to climate change through resilient farming practices and disaster preparedness.

- Research and Innovation
    - Collaboration with Research Institutions: Collaborate with research organizations to conduct studies on crop varieties, pest management, soil health, etc., and translate findings into practical solutions.
    - Innovation Hubs: Create or support innovation centers where farmers can experiment with new techniques and technologies.

- Dispute Resolution and Conflict Management: Ensure harmony and safeguard farmers' rights through effective dispute resolution and conflict management.
    - Mediation Services: Offer mediation and conflict resolution services for disputes among farmers or between farmers and other parties.
    - Protecting Farmers' Rights: Ensure that farmers' rights are protected in cases of disputes with larger corporations or governmental bodies.

- Disaster Response and Risk Management
    - Emergency Support: Provide immediate support in the form of food, shelter, and resources during natural disasters.
    - Risk Mitigation: Assist in developing risk management strategies to deal with market fluctuations, weather extremes, and other uncertainties.

- Technology: CSOs can harness the power of technology to revolutionize agriculture and benefit both farmers and consumers.
  - Technology Integration: Utilize digital platforms to disseminate information, gather feedback, and even create applications that can guide consumers through daily purchasing decisions.
  - Technology Adoption: Encourage the use of modern technology such as drones, sensors, and AI to enhance farming operations.
  - Digital Empowerment: Facilitate access to digital platforms that provide information on weather forecasts, market prices, and best practices.

c. Raising Awareness

CSOs should design culturally sensitive campaigns and educational resources that reflect Lebanon's diverse cultural landscape. These initiatives should be inclusive and relevant to all community members, taking into account various languages, traditions, and beliefs.

- Emergency Preparedness: CSOs should educate consumers about food security and safety during emergencies, such as natural disasters or political instability. They should also provide guidance on storing essential food items and understanding food supply chain risks to ensure preparedness.
- Sustainability Advocacy: CSOs should actively promote sustainable and local agriculture, emphasizing its positive impact on the environment and local economies. They should engage with consumers, encouraging responsible purchasing decisions that support eco-friendly practices and contribute to a greener and more equitable future.
- Quality of Nutrition: Raising awareness about the importance of nutritious quality is crucial, as it benefits both the government and society and thus has two extents:
  - The first extent targets the government, focusing on empirical studies that highlight the value of quality nutrition. These studies showcase the dual benefits - societal and economic - for the government. Quality nutrition leads to substantial savings on medical expenses, and improved citizen productivity, and well-being, ultimately enhancing national services and providing a competitive edge over other country.
  - The second extent is directed at society at large, emphasizing the importance of nutritious quality. This entails educating the public about quality assessment parameters and their significance. These groups empower the community by defining the minimum standard of quality as a right that should be protected by the government, highlighting that anything below this threshold would render unacceptable, and encouraging the demand for higher nutritional standards.
- Empowering Lebanese Consumers: Upholding Consumer Rights and Responsibilities: For the effective empowerment of Lebanese consumers and the protection of their rights, CSOs should prioritize the implementation of comprehensive educational resources and impactful awareness campaigns. These initiatives must aim to educate citizens about their consumer rights and responsibilities within the agricultural and agrifood sector.
  - Consumer Rights: The following are recommendations for NGOs to promote consumer rights
    - Right to Safety: Consumers have the right to food products that meet safety standards, free from harmful substances. This extends to the expectation that products are monitored and tested by appropriate authorities to ensure compliance with established regulations.
    - Right to Information: Accurate and clear information about products is a fundamental consumer right. This includes comprehensive details about ingredients, nutritional facts, allergens, origin, methods of production, and the track history of the product, such as its journey from farm to fork.
    - Right to Food Security: Consumers have the right to consistent access to sufficient, safe, and nutritious food. Ensuring food security involves not only affordability and availability but also resilience in the food supply chain to withstand shocks and crises.
    - Right to Redress and Hold Producers Accountable: If a product fails to meet standards or causes harm, consumers have the right to fair and swift remedies, such as refunds, replacements, or compensation. This includes the right to hold producers and manufacturers liable for their products, enforcing accountability through legal and regulatory means.
    - Right to Monitor and Test Products: Consumers have the right to expect that products are subjected to rigorous testing and monitoring by both governmental bodies. These tests should ensure quality, safety, and compliance with all relevant laws and standards.
    - Right to Report Misconduct and Access Reporting Systems: If consumers encounter misconduct, fraudulent practices, or any violations related to agricultural or agri-food products, they have the right to report these issues through easily accessible and transparent systems while protecting their anonymity when needed. Such reporting mechanisms should provide prompt responses and take appropriate action to address the concerns.
    - Right to Track History: Consumers have the right to access detailed information about the entire lifecycle of a product. This includes cultivation, processing, packaging, transportation, and sale. Knowing the track history can provide insights into the product's quality, environmental impact, and adherence to ethical practices.

- Right to Choose: These rights continue to encompass the freedom to choose from various products, access education that enables informed decisions, and expect products that align with sustainable and environmentally friendly practices.
- Right to Ethical Treatment: Consumers have the right to expect that products are produced following ethical standards, including fair treatment of workers, animal welfare, and environmentally responsible practices.
- Right to Privacy: Consumers should have the right to privacy in their purchasing decisions and personal information. This information should not be exploited or shared without explicit consent.
- Right to Fair Pricing: Consumers have the right to fair and transparent pricing, without hidden fees or misleading practices, allowing for a true comparison between products.

- Consumer Responsibilities: NGOs have a vital role in making people aware of their responsibilities within the agriculture cycle, which consequently affects the levels of rights they should expect to demand.
  - Responsibility to Be Informed: Consumers should actively seek out information to make informed choices about the products they purchase, such as understanding labels and recognizing quality standards.
  - Responsibility to Choose Local: Consumers have the responsibility to support local farmers and producers by purchasing locally sourced and produced agri-food products. Choosing local not only contributes to the local economy but also promotes sustainability by reducing transportation emissions and often ensures fresher and potentially more nutritious products. This bond encourages responsible farming practices and creates a more resilient food system. However, it is essential to recognize that the choice to buy local may be influenced by various factors such as availability, affordability, and personal values, so the responsibility lies in making conscious and informed decisions within individual means and contexts.
  - Responsibility to Use Products Safely: Consumers must follow guidelines and instructions for safe handling, preparation, and consumption of food products.
  - Responsibility to Voice Concerns: Report malicious acts, counterfeit products, and unethical practices in the food production process. This fosters a sense of community watchfulness and individual accountability. If they encounter issues or concerns with a product, consumers have the responsibility to report it the producer involved, and then to the appropriate authorities.
  - Responsibility to Respect Others: This includes considering the impact of their consumption choices on other people, the community, and the environment.
  - Responsibility to Participate Actively: Consumers should engage with various stakeholders, including community groups, regulatory bodies, and companies, to actively participate in shaping policies and regulations that affect the food system.
  - Responsibility to Respond to Recalls: If a product is recalled due to safety concerns, consumers are responsible for complying with recall instructions.
  - Responsibility to Demand Transparency: Consumers should actively demand transparency from producers and retailers, including clarity on pricing, sourcing, ethical considerations, and environmental impact.
  - Responsibility to Reduce Waste: Consumers have the responsibility to minimize food waste through mindful purchasing, proper storage, and responsible disposal of food items.
  - Responsibility to Encourage Sustainable Practices: By showing preference for sustainable and ethical products, consumers can encourage companies to adopt responsible practices.
  - Responsibility to Understand Individual Impact: Consumers should strive to understand the broader impact of their individual choices on the global food system, recognizing that even small daily decisions can contribute to larger societal and environmental changes.
  - Responsibility to Share Knowledge and Educate Others: As informed consumers, individuals have a responsibility to share their knowledge with others, helping to raise awareness and promote responsible consumption within their community.
  - Responsibility to Respect Cultural and Community Values: Consumers should be aware of and consider cultural and community values in their purchasing decisions, respecting diversity and different agricultural traditions.

By recognizing and emphasizing these expanded rights and responsibilities, consumers are positioned at the center of the food system, with a clear role in driving quality, safety, ethics, and sustainability. Such actions require corresponding responsibilities from producers, regulators, and other stakeholders to create an agri-food system that is responsive, transparent, and accountable to consumer needs and expectations. Efforts to uphold these rights must be underpinned by the responsibilities to ensure strong regulations, diligent oversight, collaboration, and a shared commitment to fostering the well-being of consumers and the broader community.

- Waste Management: Promoting Responsible Consumption and Reducing Food Waste: CSOs should take an active role in promoting responsible consumption and reducing food waste in the agricultural sector. Through impactful public awareness campaigns, CSOs can educate consumers on the importance of responsible consumption practices and strategies to minimize food waste at the individual level. CSOs should also advocate for the use of composting and recycling methods, emphasizing the benefits of composting organic waste and supporting initiatives that facilitate recycling programs. Collaboration with restaurants and businesses is crucial, as CSOs can provide guidance on waste reduction strategies and advocate for regulations penalizing food waste. Furthermore, fostering collaborations between food establishments and local food banks or organizations that distribute surplus food to those in need can effectively address the issue of food waste while supporting the community.
- Shifting Consumer Habits: Prioritizing Product Quality over Packaging: NGOs should take the lead in promoting a shift in Lebanese consumer habits by emphasizing the importance of product quality over packaging. Through engaging educational campaigns, NGOs can challenge prevailing misconceptions and raise awareness about the significance of product quality in the agricultural sector. Collaborating with media outlets, influencers, and community leaders, NGOs can effectively reach and influence consumer behavior. Advocating for labeling regulations and standards that clearly communicate product quality to consumers is essential for promoting transparency and informed decision-making.

The active role of CSOs in strengthening the agricultural domain emerges as a critical facet of the current situation. CSOs, comprising a diverse amalgamation of non-governmental entities, advocacy groups, non-profits, and regulatory initiatives, actively address multifarious dimensions of societal, environmental, and political concerns to instigate constructive change and augment the holistic welfare of the society.

Given the intricate socio-economic and governmental dynamics in Lebanon, the efforts of CSOs embody a pioneering response to foster an agricultural trajectory characterized by resilience, prosperity, and socio-environmental harmony.

4. General Public

Recognizing that in a democratic state, the government is a representative body of society, and a corrupt or failing government is most probably a result of a malfunctioning society, when it comes to agriculture, casting blame and awaiting long-term reform will not save society from the direct consequences of a failed agriculture sector. These consequences range from food shortages, nutritional deficiencies, and health risks to price inflation, economic impact, dependency on imports, and the weakening of rural communities. Thus, society needs to step up. While working on a somewhat long-term plan to impose the reform of government, some actions can directly positively impact the agri-food sector and allow it to survive the period in question with a certain level of resilience, minimizing direct and indirect damages on agriculture specifically, and society, the consumer, in general. The following outlines how the involvement of the general public within society can lead to improvements:

a. Knowing Your Rights and Not Settling for Less

If it is not a law-given right, it is not a right. The general public should fulfill its role in inquiring about rights when it comes to agro-food-related matters, for they encompass food safety and security, one of the main aspects of being able to lead a healthy life, if not the main one. It starts with the right to access information, ensues with the right to review set standards and assurance mechanisms, and concludes with the right to revise and demand practical amendments and betterment.

b. Knowing Your Responsibilities and Acting Upon Them

Rarely do rights come without accompanying responsibilities. In many ways, fulfilling these responsibilities is a means of safeguarding those rights. Recognizing and upholding these rights is essential; diminishing the associated responsibilities can quickly lead to a deterioration in the quality of those rights.

c. Embracing Civic Duties and Fostering Responsible Practices

- Monitoring and Reporting: Engage in active monitoring of agricultural practices and promptly report any misconduct or substandard activities, contributing to the sector's integrity.
- Supporting Accountability Initiatives: Back efforts that hold producers and regulatory bodies accountable, ensuring compliance with rigorous agricultural standards.
- Practicing Social Accountability: Utilize social media and public platforms to encourage responsible practices, incentivizing ethical methods among producers.

d. Being Proactive

- Cultivating Community Gardens: Establishing community gardens empowers urban residents to grow their own produce and raises awareness about agricultural practices.
- Promoting Farmers' Markets: Supporting or organizing local farmers' markets strengthens the connection between farmers and consumers.
- Fostering Agricultural Innovation: Supporting local innovation hubs for agricultural technology development encourages the growth of new farming methods and tools.
- Supporting Farm-to-Table Initiatives: Encourage sourcing directly from local farmers to strengthen the farm-to-table movement.
- Protecting Wildlife Habitats: Advocate for the preservation of wildlife habitats, promoting biodiversity in agricultural landscapes.
- Providing Aid During Crises: Extend support to farmers during agricultural crises, fostering resilience in the sector.
- Engaging in Advocacy: Advocate for agricultural-friendly policies by pressuring representatives to prioritize local and sustainable agriculture.

e. Engaging and Participating in Change

- Lobbying for Policy Changes: Individuals and groups can advocate for policies and regulations that support sustainable farming, local products, and fair trade.
- Promoting Indigenous Agricultural Practices: Raise awareness about and support the preservation of indigenous farming methods.
- Sharing Information about Quality Products: Spread awareness about high-quality agricultural products and their benefits to consumers.
- Supporting Citizen Science Initiatives: Participate in citizen science programs focused on agricultural research and data collection.
- Encouraging Youth Engagement: Promote programs that engage young people in agriculture and farming activities.

- Supporting School Agricultural Programs: Support school-based agricultural programs and gardening projects to educate students about farming and sustainable practices.

f. Making Informed Choices

- Eating Healthy: Choose nutritious food options that promote overall well-being and support local farmers.
- Supporting Local Farmers: By purchasing locally sourced products, consumers directly contribute to the growth and sustainability of their community's agriculture.
- Favoring Sustainability: Opt for sustainable and organic products to encourage environmentally friendly agricultural practices and protect the planet.
- Promoting Sustainable Practices: Support and adopt water and resource conservation measures to preserve ecological balance.
- Prioritizing Soil Health: Promote practices that enhance soil health.

g. Valuing Quality and Ethical Practices

- Recognizing and Rewarding Quality: Appreciate and support agricultural processes that prioritize quality, even in small ways.
- Promoting Fair Labor Practices: Advocate for fair treatment and working conditions for farm workers.
- Supporting Animal Welfare: Promote and encourage farming practices that prioritize the well-being of animals.

h. Boosting Agricultural Investment

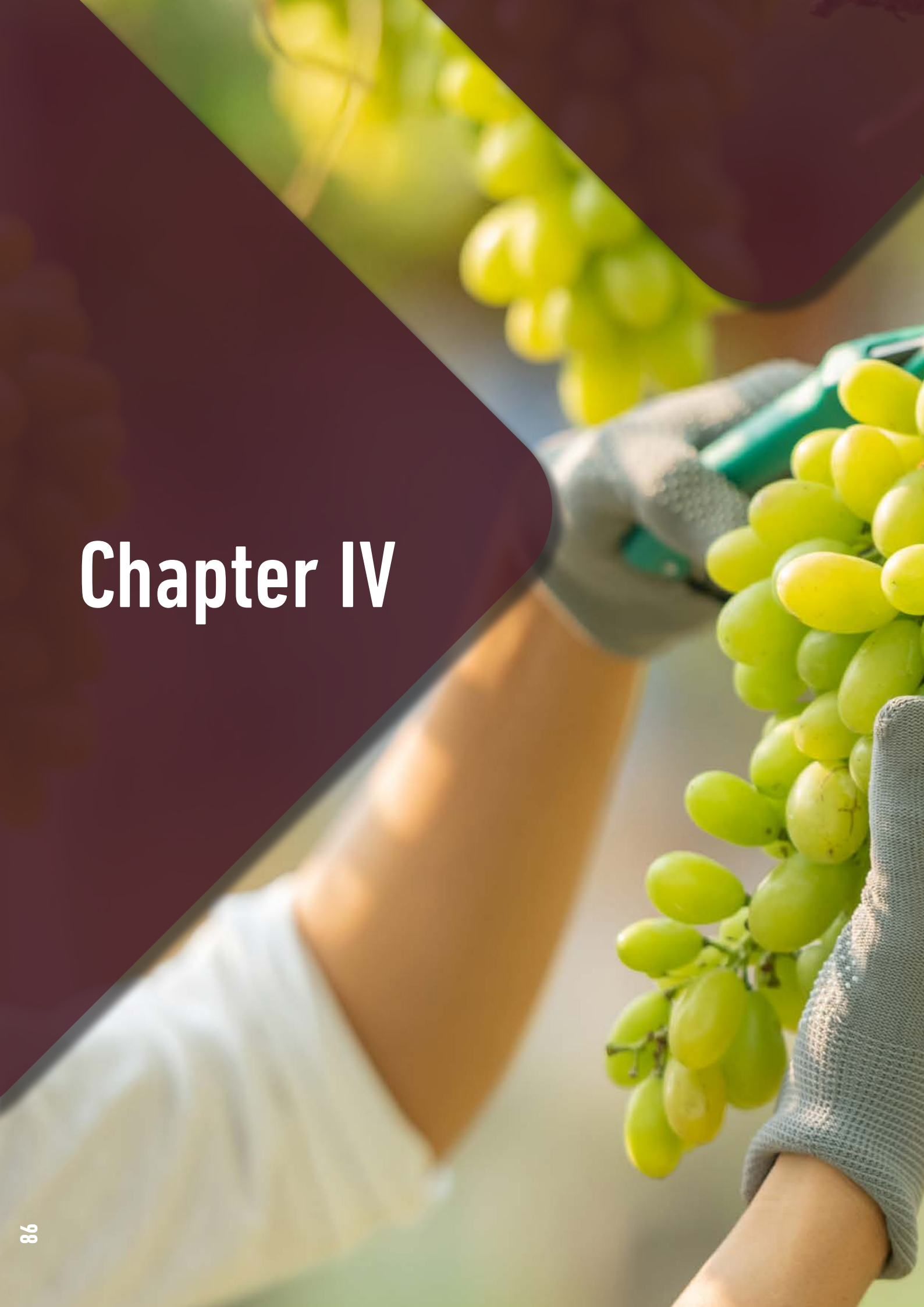
- Crowdfunding and Microloans: Public investment in small and local farms through crowdfunding or microloans can provide essential financial support, pushing for improvement.
- Cooperative Models: Encouraging and participating in cooperative farming models allows the pooling of resources and shared ownership of agricultural production.
- Subscription Farm Boxes or Community Supported Agriculture (CSA): Supporting subscription farm boxes or CSA programs fosters a direct connection between consumers and local farmers, ensuring a steady income for farmers and access to fresh produce for consumers.

i. Empowering through Volunteering and Philanthropy

- Volunteering Time: Individuals can contribute their time and skills by volunteering on local farms or with organizations focused on agricultural development.
- Donations: Philanthropic efforts to support agricultural initiatives can provide much-needed funds and resources to promote sustainable farming practices and enhance food security.

By leveraging these strategies, society can take an active, multifaceted approach to support and improve the agriculture sector. These grassroots efforts can fill the void left by an absent or incapacitated government, enabling a resilient and flourishing agricultural system that is more aligned with local needs and sustainable practices.

Chapter IV



Navigating Towards Sustainable and Efficient Agriculture

IV

Navigating Towards Sustainable and Efficient Agriculture

The comprehensive study, "Towards Agricultural Sustainability and Efficiency: Gaps, Bottlenecks and Prospects," traces the intricate and diverse pathways of Lebanon's agricultural sector. Relying on a wide range of sources, expert insights, and detailed analysis, the report charts a realistic and reform-oriented course for Lebanon's agriculture.

The investigation underscores that the focus of agriculture in Lebanon should not be merely on production volume, but critically on the quality of its output. This emphasis on quality rather than quantity sets the foundation for recommendations that favor sustainable and efficient farming practices, effective stakeholder engagement, and building a resilient sector capable of withstanding economic and environmental challenges.

The Comprehensive Assessment and Mapping of Lebanon's Agricultural Landscape reveals that while Lebanon's agricultural sector is rich in potential, it is also fraught with challenges. From land use and stakeholder roles to trade dynamics and food security, the sector is a complex web of interconnected elements. Understanding these elements and their interaction is paramount to charting the path towards sustainability and efficiency.

The detailed Stakeholders' Needs Assessment provides valuable insights into the ground realities, aspirations, and needs of those directly involved in the sector. These insights shape a comprehensive understanding of the sector and its challenges, contributing to a realistic and grounded roadmap for reform.

The unveiling of the "A Comprehensive Roadmap for Sustainable Agriculture" indicates that the journey towards sustainable and efficient agriculture in Lebanon demands a collective effort. The proposed roadmap is not merely a list of recommendations but a strategic guide, reflective of the sector's unique realities and potential.

This roadmap signifies a crucial shift in focus, from mere production volumes to the quality of agricultural output, the environmental footprint of farming practices, and the wellbeing of those dedicated to the land. It advocates for an approach to agriculture that respects the land, uses resources wisely, fosters innovation, and positions farmers as custodians of Lebanon's rich agricultural heritage.

The study underscores that Lebanon's agricultural potential can be realized with strategic vision, effective policies, and engaged stakeholders. The path ahead is undoubtedly challenging but not insurmountable. Armed with this roadmap, the journey towards a sustainable, resilient, and prosperous agricultural sector is clear for the benefit of Lebanon and its future generations.

In conclusion, the focus should not be just about growing more, but growing better. This study reaffirms that Lebanon's agriculture sector holds the promise and potential to ensure food security, contribute significantly to the national economy, and preserve the rich biodiversity of the country. It also emphasizes that the path to realizing this potential lies in understanding the sector's unique challenges, learning from best practices, fostering collaboration among stakeholders, and, above all, adhering to a roadmap that promotes sustainability and efficiency at its core. The time for action is now, to sow the seeds of change and reap a harvest of prosperity for Lebanon.

Annexes

Annexes

A. List of Acronyms

ADR	Association for the Development of Rural Capacities
AEP	Association d'entraide Professionnelle
AFD	Agence Française de Développement
AREC	Advancing Research Enabling Community Center
AUB	American University Beirut
CAS	Central Administration of Statistics
CCIA-BML	Chamber of Commerce, Industry, and Agriculture Beirut and Mount Lebanon
CDR	Council for Development and Reconstruction
CEO	Chief executive officer
CNRS	National Council for Scientific Research
CPF	Country Programming Framework
CREAL	Centre de Recherche et d'études Agricoles Libanais
EFTA	European Free Trade Agreement
ESDP	European Spatial Development Planning Network
ESFD	Economic and Social Fund for Development
EU	European Union
FAFS	Faculty of Agriculture and Food Sciences
FAO	Food and Agriculture Organization
FCCIA	The Federation of Chambers of Commerce, Industry and Agriculture
FTA	Free trade agreements
GAFTA	Greater Arab Free Trade Area
GDP	Gross Domestic Product
GIS	Geographical Information system
GIZ	Gesellschaft für Internationale Zusammenarbeit
ICARDA	International Center for Agricultural Research in the Dry Areas
IDAL	Investment Development Authority of Lebanon
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFI	Issam Fares Institute for Public Policy and International Affairs
ILO	International Labor Organization
IRA	Industrial Research Achievement
IRI	Industrial Research Institute
ITC	International Trade Centre
KfW	German development bank
LARI	Lebanese Agricultural Research Institute
LAUA	Lebanese Association for Urban Agriculture
LDEM	Landscape Design and Ecosystem Management
LEAF	Laboratories for the Environment, Agriculture, and Food
LIBNOR	Lebanese Standard Institution
MEW	Ministry of Environment and Water
MFI	Microfinance institution
MOA	Ministry of Agriculture
MoET	Ministry of Economy and Trade
MoF	Ministry of Finance
MoI	Ministry of Industry
MoPH	Ministry of Public Health
NAS	National Agriculture Strategy
NFSC	Nutrition and Food Sciences
NGO	Non-governmental organization
OECD	Organization for Economic Co-operation and Development
Sqm	Square Meter
TIFA	Trade and Investment Framework Agreement
UNCE	United Nation Correspondents' Association
UNDP	United Nations Development Programme
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNICEF	The United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
USGS	United States Geological Survey
WFP	World Food Programme

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C. List of Lebanon's Bilateral Trade Agreements

Country	Date Signed	Highlights
Egypt	September 1998	Free trade zone agreement.
Iran	October 1997	Framework agreement.
Iraq	April 2002	Free trade agreement.
	December 1999	Encourages economic, trade, technical cooperation and the exchange of expertise.
	April 1967	Lists tariff reductions and exemptions. Most favored nation (maritime). Allows free zones.
Jordan	April 1967	Lists tariff reductions and exemptions. Defines rules of origin.
Kuwait	January 1996 September 1998	Tariff reduction and exemption. Defines rules of origin.
Morocco	March 1972	Encourages cooperation in agriculture, industry and the establishment of joint ventures.
Qatar	August 2000	Framework agreement.
Saudi Arabia	November 1971	Encourages transit trade, tourism, capital movement, most favored nation (transport), cooperation in custom regulations.
Syrian Arab Republic	August 1998	Reduces tariff rate on industrial products by 25% per annum.
Turkey	October 1991	Encourages trade, economic, industrial and scientific cooperation.
United Arab Emirates	April 2000	Free trade zone agreement. Lists tariff exemptions and reductions.
Yemen	November 2000	Encourages economic cooperation and the exchange of experience. Framework agreement (encourages trade).

Table 9: List of Lebanon's Bilateral Trade Agreements. Sources: Ministry of Economy and Trade, 2022 & FAO Agriculture Sector Review, 2021

D. List of Agricultural Machinery Providing Companies

Company	Area
Agrika SARL	Zahle
Agroline	Akkar
Agronor	Akkar
AIDCO for Agriculture, Trading and Commerce SARL	Zahle
Al Maadat Al Ziraaiya SARL	Zahle
Ali chamaa	Akkar
Bekagro-Kassouf for Agriculture	Zahle
Comptoir agricole	Tripoli
Dally for Agriculture and General Trading, Dalyco	Zahle
Debbane Frères Trading SAL	Zahle
Debbane freres	Tripoli
Joseph Hanna Est	Zahle
Matta Saba	Akkar
Mchayleh	Akkar
Omar Hayek	Akkar
Robinson Agri	Jbeil
Sarraj	Akkar
Simon Yacoub	Akkar
Unifert	Tripoli
Unifert SAL	Zahle

Table 10: List of Agricultural Machinery Providing Companies. Source, Agvisor Application, 2022

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