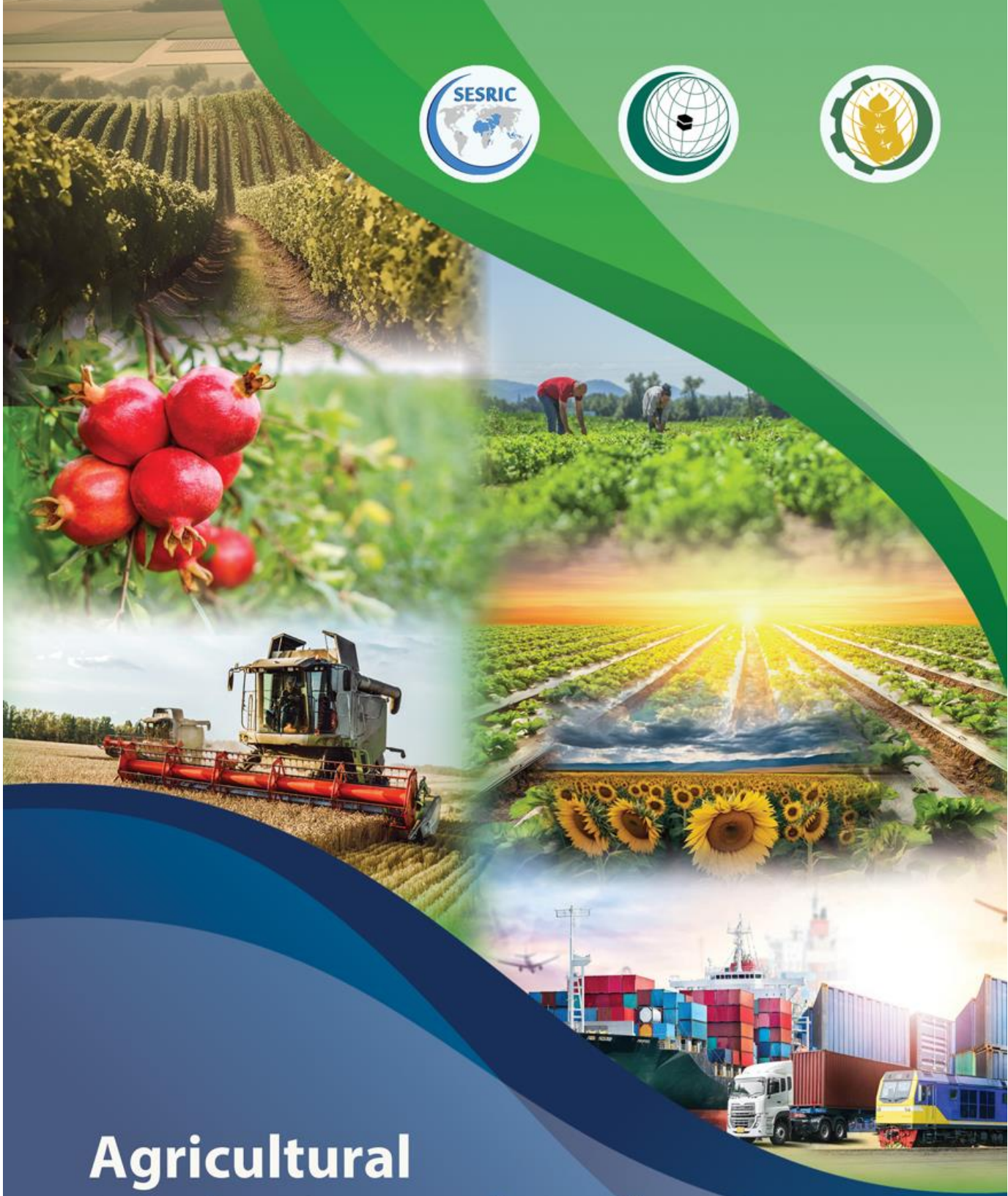

Agricultural Production and Trade

Complementarities among OIC Countries

AGRICULTURAL PRODUCTION AND TRADE

Complementarities among OIC Countries

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Contents

ACRONYMS

COMCEC	Standing Committee for Economic and Commercial Cooperation of the OIC
COMSTECH	Standing Committee for Scientific and Technological Cooperation of the OIC
ERS-USDA	Economic Research Service of the United States Department of Agriculture
FAO	Food and Agriculture Organization of the United Nations
GII	Global Innovation Index
GVC	Global Value Chain
HS	Harmonized System
ICDT	Islamic Centre for Development and Trade
IOFS	Islamic Organisation for Food Security
IR	Intensity Ratio
IsDB	Islamic Development Bank
OIC	Organisation of Islamic Cooperation
R&D	Research and Development
RCA	Revealed Comparative Advantage
SDGs	Sustainable Development Goals
SESRIC	Statistical, Economic and Social Research and Training Centre for Islamic Countries
SMEs	Small and Medium-sized Enterprises
SMIIC	Standards and Metrology Institute for the Islamic Countries
TCI	Trade Complementarity Index
TFP	Total Factor Productivity
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization
WIPO	World Intellectual Property Organization

FOREWORD

The agriculture sector plays a vital role in the economies of many OIC member countries by providing food, income, and employment to millions of people. It is also instrumental in achieving the Sustainable Development Goals, particularly Goal 2 on ending hunger by 2030. Recognizing the significance of agriculture, the OIC Programme of Action 2025 prioritizes agricultural productivity as a key development objective for member countries, aiming to enhance economic growth, reduce poverty, and improve the well-being of their populations.

We are delighted to present this joint report on "Agricultural Production and Trade: Complementarities among OIC Member Countries," prepared by the Statistical, Economic, and Social Research and Training Centre for Islamic Countries (SESRIC) and the Islamic Organization for Food Security (IOFS). This report emphasizes the need to optimize the utilization of available agricultural resources, enhance food production, and strengthen agro-food industries to improve food security and decrease reliance on imports. Additionally, it explores the potential for intra-OIC trade in agro-food products as a catalyst for economic growth and development.

The discussion on major trends that are shaping agricultural production and productivity underpins a number of critical issues that demand our attention. Firstly, there is a concerning deceleration in the growth rate of agricultural production across OIC countries, experiencing a decline from an average annual rate of 3.2% in the 2000s to 2.6% in the 2010s. This downward trend raises apprehensions regarding the realization of agricultural potential, the ability to meet surging food demands, and the reduction of dependence on imports within OIC countries. Secondly, a distinct reduction in the intensity of labour utilization becomes evident, as farmers are leaving rural areas due to low farm revenues and difficult working conditions. Consequently, a scarcity of labour emerges, hindering productivity. The report also emphasizes that the growth of agricultural production in OIC countries has predominantly relied on augmenting resources and inputs such as land, labour, and capital, rather than achieving productivity gains, thereby revealing lower levels of land and labour productivity. Addressing the pressing issue of poor productivity holds paramount importance for OIC countries as it exerts a direct impact on agricultural production, food security, and socio-economic development. In this context, the complementarity of agricultural resources among member countries exhibits substantial potential in fortifying resilience in food production through resource and expertise exchange.

The report emphasizes the tremendous potential for development within the agro-food industry, which has significantly contributed to global economic growth, particularly in developing countries. Although OIC countries have a lower level of food industry development than the global average, the sector has demonstrated faster growth rates over the past decade. Technological innovations are identified as critical catalysts for enhancing the efficiency, quality, and competitiveness of manufacturing processes in the agro-food industry.

The report also sheds light on the comparative advantages and potential complementarities in agricultural trade among OIC countries. While several commodities demonstrate comparative advantages, high trade costs and barriers can hinder growth, even in the presence of complementarities. The report emphasizes the need to reduce tariff and non-tariff barriers, improve market intelligence, and enhance customs formalities to fully exploit the benefits of complementarity and foster agricultural trade among member countries.

The analysis throughout the report points to considerable potential for OIC member countries to collaborate and leverage their efforts to enhance food security and economic development. To this end, the report presents thirteen potential areas of cooperation among member countries, spanning finance, research and extension services, governance, and rural development and resource quality improvements. The insights and recommendations presented in the report are expected to benefit policymakers, investors, and other stakeholders in the sector. Together, by leveraging our strengths, sharing knowledge, and fostering collaboration, we can shape a future where agricultural resources are optimized, food production is enhanced, and agricultural trade flourishes, benefiting the economies and livelihoods of all OIC member countries.

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Dr. Fahman Fathurrahman, Researcher at SESRIC, prepared Chapter 1 on Introduction and Chapter 2 on Agricultural Production and Productivity. Chapter 3 on Agro-Food Industries and Food Security was prepared jointly by Dr. Fahman Fathurrahman, Dr. Shakhlo Atabaeva (Program Manager at IOFS) and Dr. Suat Atan (Program Manager at IOFS). Dr. Kenan Bağcı, Senior Researcher at SESRIC prepared Chapter 4 on Trade Complementarity of Agriculture Commodities. All the authors contributed to the preparation of Chapter 5 on Concluding Remarks. Mr. Fadi Farasin, Assistant Director General of SESRIC and Dr. Esat Bakımlı, Senior Researcher at SESRIC, contributed to the review of the report.

EXECUTIVE SUMMARY

Improved resource-use efficiency in agriculture is urgently needed

The utilization of agricultural resources is a crucial determinant of the overall productivity of the agriculture sector. On average, OIC countries have lower levels of land and labour productivity compared to global averages. Furthermore, the majority of countries with traditional agriculture and poor productivity are low-income countries, which may have repercussions for agricultural production, food security, and socioeconomic development.

The growth rate of agricultural production in OIC countries has witnessed a decline over time. In the period between 2001 and 2010 (2000s), the average annual growth rate stood at 3.2%. However, from 2011 to 2020 (2010s), this rate dropped to 2.6%. This decrease can be partly attributed to a reduction in productivity, as evidenced by the decline in Total Factor Productivity (TFP) from 1.45% per year in the 2000s to 0.83% in the 2010s. Different inputs in agriculture had varying trends: the labour input decreased with an annual growth rate of -0.35% in the 2010s, while the agricultural land expanded, growing from 0.79% per year in the 2000s to 1.39% in the 2010s.

In general, the growth of agricultural production output in OIC countries has primarily been driven by an increase in resources and inputs (e.g., land, labour, and capital) rather than productivity gains. Nevertheless, within different income groups, the pattern varies. Until 2014, high-income OIC countries experienced a slow production output growth as a result of declining productivity. However, they were able to subsequently accelerate their production output growth thanks to a significant increase in productivity. Upper-middle-income OIC countries had the lowest production output growth, but the growth was primarily driven by a boost in productivity, which grew at a faster pace than inputs. In lower-middle-income OIC countries, the high production output growth in the past decades was due to a combination of both inputs and productivity, although productivity growth has stagnated in the past 5 years. Agricultural production output grew the fastest in low-income OIC countries, but this growth was primarily reliant on the addition of inputs rather than an increase in productivity. In addition, a noticeable trend among all income groups is that there is a decreasing rate of labour intensification. Many farmers are moving from rural areas to cities due to low farm revenues and difficult working conditions. As a result, there is a shortage of labour in agriculture, which is causing a decrease in productivity.

The agriculture sector requires immediate attention to enhance its productivity especially in lower income economies. A significant contributing factor to bridging the gap in productivity is the cooperation among member countries. It is imperative for member countries to acknowledge their resource endowments and utilize them optimally for maximum productivity. Additionally, agricultural research and development (R&D) is essential to boost the productivity of the agriculture sector, especially since the majority

of OIC countries currently lack R&D capacity. Finally, strategic investments targeted towards the specific needs of the sector can further improve productivity.

Agro-food industry has great potential for development

The agro-food industry has significantly contributed to the economic growth of the world especially in developing countries. Among the various components of agro-food industrial activities, the food industry is the most significant in both developed and developing countries. OIC countries have a per capita value added of food industry of US$ 90, indicating a lower level of food industry development than the world average level (US$ 243). However, the food industry has demonstrated a faster growth rate in OIC countries than in other regions, with an annual growth rate of 5.2% over the past decade.

The level of development of food industry varies significantly among OIC member countries. Most OIC countries have either low or medium levels of development, and only a few have high levels. Despite the absence of proper infrastructure and skilled labour in some countries, the availability of raw materials at reasonable prices presents a tremendous opportunity for growth in the industry. Understanding the level of development of the agro-food industry requires taking into account various factors such as the level of technology and innovation, the level of competition, and the quality of infrastructure and institutions. Technological innovations and advancements play a crucial role in enhancing the efficiency, quality, and competitiveness of manufacturing processes in the agro-food industry.

OIC countries have comparative advantages in a number of agro-food commodities

Assessment on the recent trends and developments in agricultural trade indicates comparative advantages in a number of commodities as well as potential complementarities among OIC countries. Over a period 2016-20, with an annual average export value of US$ 36.8 billion, ‘Animal and vegetable fats and oils’ is the top export product category, 30.6% of which are exported intra-OIC. 81% of ‘Meat and edible meat offal’, 79% of ‘Live animals’, and 77% of ‘Dairy products, eggs and products of animals’ were exported to other OIC countries, reflecting strong intra-OIC trade relationships in these products. In terms of the three strategic products (wheat, rice, and cassava), OIC countries remain net importers, demonstrating the need for improving capacities and productivity in these products. While improving agricultural productivity is crucial, investments should also be made to enhance domestic capacity to process primary agricultural products, as exemplified in the case of wheat flour.

Agricultural products face higher trade costs than manufactured products do, but there is no indication that higher tariffs are related to lower import values. Still, measures should be taken to reduce tariff and non-tariff barriers to facilitate agricultural trade in OIC countries. Currently, many OIC countries have comparative advantages in certain agricultural products, but high trade costs in food and agriculture can offset the influence of comparative advantage and prevent growth of trade even in the presence of significant complementarities. It is shown that even though some OIC countries have high

complementarity in agricultural trade, they do not trade with each other at all. In order to reap the benefits of complementarity, the concerned countries should endeavor to increase market intelligence, reduce trade barriers, and improve customs formalities.

Possible areas of cooperation for enhancing complementarities

Working together to improve the agriculture sector and food security could be very beneficial for OIC member countries. Cooperation between countries can lead to more efficient resource management, enhanced food production, and expanded agro-food trade, all of which contribute to long-term growth and prosperity. There are at least 13 potential areas of cooperation that can be explored, which fall under four cross-cutting themes: finance, research and extension services, governance, and rural development and resource quality improvements.

Improving access to finance and getting the private sector involved can have significant impact to make the agro-food industry more efficient and productive. Collaboration between countries can also help to share knowledge, best practices, and technologies that can lead to greater investment in R&D. Moreover, governments can develop policies and regulations that incentivize sustainable practises and discourage unsustainable ones. Policies such as land tenure and property rights, price policies and trade, access to markets, and institutional capacity to support the growth of the agro-food industry should be pursued, in a way that benefits both the economy and the environment. Cooperation can also lead to the development of trade agreements that can help facilitate trade in agricultural products and reduce trade barriers, leading to increased market access.

Additionally, rural development and resource quality improvements play a significant role in the overall improvement of the agro-food industry. This includes initiatives such as rural education and training, infrastructure development, and the promotion of sustainable soil and water management practices. By focusing on these areas of cooperation, countries can work towards better food security and more sustainable agricultural development.

1 INTRODUCTION

Agriculture is a vital sector of economies worldwide, particularly in OIC member countries. The agriculture sector serves as an essential source of income for millions of people in OIC countries, which are endowed with abundant agricultural resources. The development of this sector is also critically important for achieving the 2030 goal of ending hunger, as promoted in the Sustainable Development Goals (SDGs).

As stipulated in the OIC Programme of Action 2025, agricultural productivity is one of the key development priorities for the OIC member countries seeking to enhance their economic growth, reduce poverty, and improve the well-being of their populations. On the other hand, food production is essential to ensuring food security and meeting the growing demand for food due to population growth. However, the challenge faced by many OIC member countries is that they have not been able to realise their full potential in agriculture and food production. Despite having significant agricultural resources, many OIC member countries still struggle with food insecurity, malnutrition, and poverty. Moreover, these countries often rely on imports to meet their food needs, which can be expensive and unsustainable in the long run.

The effective use of agricultural resources (e.g., labour, land, water, and fertilisers) is critical for optimising food production. This can allow countries to increase their food production and decrease their reliance on imports. To this end, complementarity in agricultural resources among member countries can play a vital role. Countries can ensure food production resilience by sharing resources and expertise.

Moreover, it is important to strengthen agro-food industries and increase food production to make sure that people have access to enough healthy food. By working together to improve agro-food production and industries, OIC countries can increase their overall food supply, cut down on waste, and give the people a wider range of healthy diets.

In terms of trade, complementarity is crucial for encouraging economic growth and ensuring food security. OIC countries can gain access to foods that they cannot produce themselves through trading of agro-food products. This is especially beneficial in areas where specific products are scarce. Trading agro-food products can also have economic benefits by promoting job creation and increasing exports.

This report analyses the complementarity of agricultural production and trade among OIC member countries and identifies possible areas for closer collaboration to promote more sustainable and inclusive growth. The report examines the potential for increasing food security and decreasing reliance on imports through optimising the use of available agricultural resources, increasing food production, and strengthening the agro-food industries. Furthermore, the report investigates the potential for intra-OIC trade in agro-food products to boost economic growth and development.

2 AGRICULTURAL PRODUCTION AND PRODUCTIVITY

The OIC comprises 57 member countries, each endowed with unique agricultural resources and potential. Agriculture holds significant importance for many OIC nations, serving as a vital sector that not only sustains their economies but also provides food, income, and employment opportunities to millions of people.

The effective and efficient utilization of agricultural land stands as a crucial factor in promoting agricultural development. As of 2020, the OIC countries collectively possess a vast agricultural land area of 1.4 billion hectares, accounting for approximately 28.8% of the world's total agricultural land. Furthermore, labour is another invaluable resource in the agricultural sector. There were around 933 million people (48.2% of OIC total population) living in rural areas, which involved directly or indirectly in agricultural activities.

This chapter provides a comprehensive overview of agricultural production, focusing on its sources of growth and the current status of agricultural productivity.

Sources of Agricultural Production Growth

Over the past two decades, there has been a gradual decline in the share of agriculture within the total GDP of OIC countries. This decrease can be observed from 11.8% in 2000 to 10.4% in 2021. Similar trends have been witnessed in other regions, such as developing countries, where agriculture's contribution to GDP declined from 9.7% in 2000 to 8.2% in 2021. In developed countries, the decline was even more pronounced, with agriculture accounting for 1.5% of GDP in 2000 and 1.2% in 2021. In contrast, at the global level, there has been a slight increase in the contribution of agriculture to GDP, rising from 3.3% in 2000 to 4.3% in 2021.

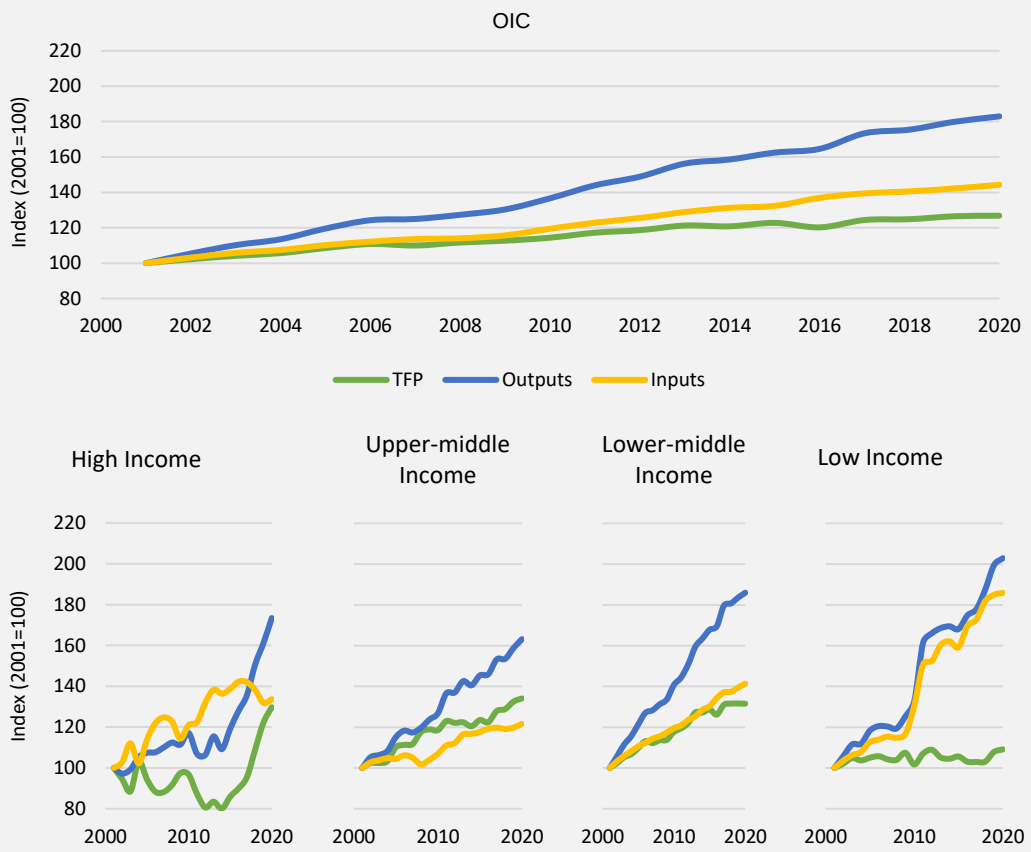
This relative decline in agricultural value addition to GDP in the developing world can be attributed to various factors. These include structural transformation, which has led to a shift of economic activities away from agriculture; agricultural market instability, which has affected the profitability and viability of farming; environmental stresses, such as climate change and natural disasters, impacting agricultural productivity; and the depletion or degradation of land and water resources. Collectively, these factors have contributed to the diminishing role of the agricultural sector in the overall economy, making room for sectors like services, industry, and manufacturing to gain a larger share of GDP.

The analysis in this sub-chapter measures the agricultural production output growth and identifies proximate sources of this growth in the face of the structural change observed during the last two decades between 2001 and 2020. It follows the methodology in Fuglie (2015) and employs data from the Economic Research Service of the United States Department of Agriculture (ERS-USDA).

Despite the decline of agriculture contribution to GDP, there has been a substantial increase in agricultural production in the OIC countries over the past decades. From 2001 to 2020, agricultural production output in OIC countries saw a growth of 83%, amounting to a value of US$ 717 billion in 2020. During this period, production output growth varied among different country income groups, with lower income countries experiencing the highest increase. Specifically, lower-middle- and low-income countries recorded an increase in production output of 86% and 103%, respectively, while high-income countries had a growth of 73% and upper-middle-income OIC countries recorded a growth of 63%.

The growth of agricultural production output can be achieved through a combination of enhanced productivity and an intensification of inputs. Productivity is commonly evaluated through the Total Factor Productivity (TFP), which measures the efficiency of total inputs (land, labour, capital, and materials) utilization to produce crops and livestock. TFP is computed as the ratio of total agricultural production output to total production inputs. When more production output is made with the same amount of resources, it means that the resources are being used more efficiently, i.e. TFP is going up.

Figure 2.1 Trend in Agricultural Production output, Input, and Total Factor Productivity (TFP) in OIC Countries, 2001-2020



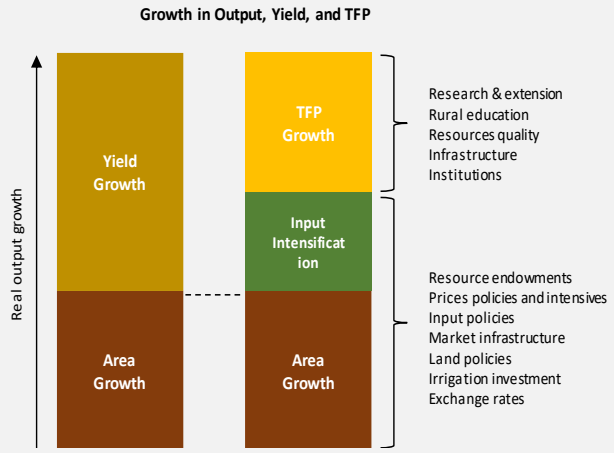
Source: Own calculations based on data from ERS-USDA.

The trends in agricultural, input-use, and TFP during the period from 2001 to 2020 are illustrated in **Figure 2.1** for OIC countries, grouped by income level. The indices show the growth in total agricultural production outputs and total input use relative to 2001 levels. The gap between the production output and input indices in the figure shows the impact of TFP growth on output. In other words, without TFP growth, the growth of production output would match the growth of input.

The growth of production output in OIC countries has primarily been driven by an increase in inputs rather than by gains in productivity. Between 2001 and 2020, inputs grew by 44%, outpacing the growth of TFP, which was only 27%. In high-income countries, the growth of agricultural production output was slow until 2014, but then

BOX A Decomposition of Agricultural Output Growth

The graph shows the decomposition of the growth of agricultural output into various factors. The height of the bars represents the rate of growth of real output, which can be further divided into two components: expansion of agricultural land (extensification) and increase in yield per hectare (intensification). The growth in yield can be further broken down into input intensification (increased capital, labour, and fertilizer per hectare) and growth in total factor productivity (TFP), which measures the efficiency of inputs in producing outputs and is influenced by technological advancements, efficient resource utilization, and economies of scale. The growth in factor inputs is determined by changes in input and output prices and terms of trade. This decomposition of output growth into its components has both practical and policy implications, as factors such as land expansion and input intensification are greatly impacted by resource availability and prices, while TFP growth is driven by long-term investments in areas such as agricultural research and development, education, infrastructure, resource quality, and institutional improvements.



Source: Adapted from Fuglie (2015).

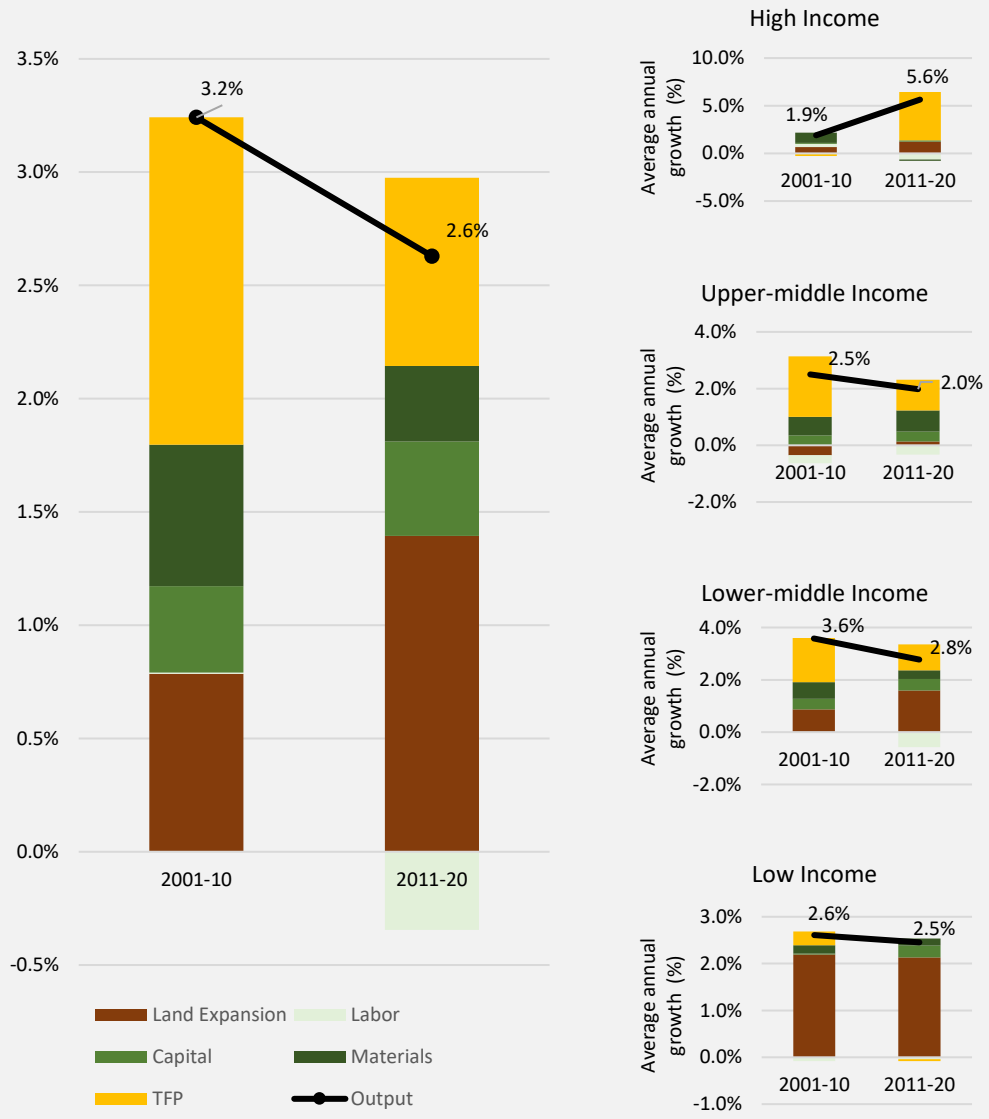
accelerated rapidly till 2020. The slow growth during the early period can be attributed to declining TFP, and subsequently, the acceleration in later years was due to the significant rise in TFP.

Production output growth was the lowest in upper-middle-income countries. However, the growth in this group was primarily driven by a boost in TFP, which grew at a faster pace than inputs. In lower-middle-income countries, the high production output growth was due to a combination of both input and TFP growth, although TFP growth has stagnated in the past 5 years.

Agricultural production output in low-income countries grew the fastest, but this growth was primarily reliant on the addition of inputs rather than an increase in productivity. Productivity in this group has been stagnant, which is typical of low-income economies due to factors such as a growing population and increased demand for food as income rises (USDA ERS, 2022).

The aforementioned trend provides an overview of the sources of agricultural production output growth, but further analysis, such as the decomposition method, is needed to fully understand the factors contributing to the growth of production output (refer to **BOX A**). **Figure 2.2** presents the growth of agricultural production output in OIC countries between 2001 and 2020, separated into two decades and based on input use and TFP. The figure groups the countries by income level and highlights the annual growth rate for each period.

Figure 2.2 Sources of Growth in Agricultural Production output in OIC Countries, 2001-2020



Source: Own calculations based on data from ERS-USDA.

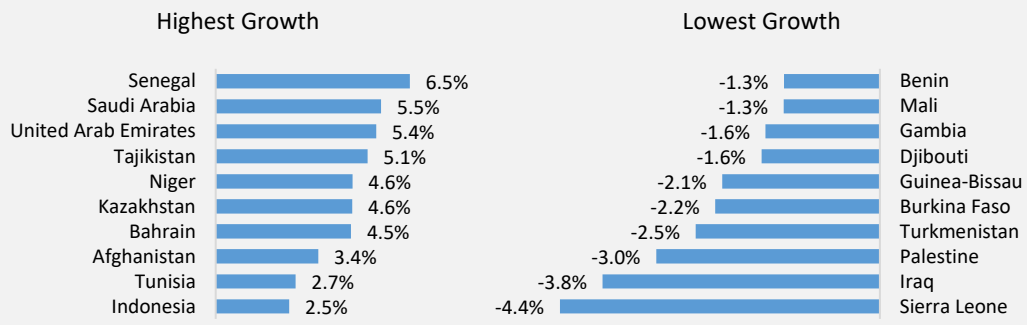
In general, the growth rate of agriculture production output in OIC countries has slowed down, moving from an average of 3.2% per annum (p.a.) in the period 2001-2010 (2000s) to 2.6% p.a. in the period 2011-2020 (2010s). The decrease is partially attributed to a drop in productivity, as TFP declined from 1.45% p.a. in the 2000s to 0.83% in the 2010s. The intensification of inputs varied between inputs, where the labour input shrank

with an annual growth rate of -0.35%. Conversely, the expansion of agricultural land continued, growing from 0.79% p.a. in the 2000s to 1.39% in the 2010s.

With regard to the income groups, agricultural production output growth slowed down in the 2010s in all but high-income countries. Agricultural production output in the high-income group grew strongly at 5.6% p.a. largely due to a stronger TFP growth in the 2010s (5.1%) than in the 2000s (-0.3%). The increase in productivity also offset the decrease in inputs. Thus, high rate of TFP growth enabled the agriculture sector of these countries to remain competitive. Over the past years, high-income OIC countries have invested in ways to boost agricultural productivity, partly to offset their limitations in resource endowments as these countries typically have limited land and water resources (see **BOX B** for an example).

Agricultural production output in the other income groups tends to exhibit a diminishing annual growth rate, attributable to a decline in TFP. In low-income countries, the average annual growth of TFP during the 2010s was even negative (-0.04%), and the majority of production output growth was due to land expansion, as was the case in lower-middle-income countries. Production output growth in upper-middle-income countries relied more on input intensification. Many OIC countries in Sub-Saharan Africa have experienced significant expansion of agricultural land due to increase in food demand, favourable resource endowments for agriculture, strong socioeconomic relevance, and strong government support for the sector (Santpoort, 2020).

Figure 2.3 Annual TFP Growth Rate in OIC Countries, 2011-2020 (Top 10 highest and lowest)



Source: Own calculations based on data from ERS-USDA.

Moreover, a notable trend across all income groups is the decreasing rate of labour intensification. The shift of farmers from rural areas to cities due to low farm revenues and difficult working conditions has led to a shortage of labour in agriculture, resulting in decreasing productivity. Additionally, young people leaving rural communities has led to an aging population, further exacerbating food shortages and increasing dependence on costly imports (SESRIC & ICD, 2022). This emphasises the urgent need to address

these issues, such as by creating a balance between labour and technology and ensuring workers are valued, productive, and motivated.

The annual growth rate of TFP is notably diverse across individual OIC countries. As seen in **Figure 2.3**, during the 2010s, the top ten highest TFP growth rates were recorded in Senegal (6.5% p.a.), Saudi Arabia (5.5%), United Arab Emirates (5.4%), Tajikistan (5.1%), Niger (4.6%), Kazakhstan (4.6%), Bahrain (4.5%), Afghanistan (3.4%), Tunisia (2.7%), and Indonesia (2.5%). On the other hand, the lowest TFP growth rates were recorded in Benin (-1.3% p.a.), Mali (-1.3%), Gambia (-1.6%), Djibouti (-1.6%), Guinea-Bissau (-2.1%), Burkina Faso (-2.2%), Turkmenistan (-2.5%), Palestine (-3.0%), Iraq (-3.8%), and Sierra Leone (-4.4%). The growth of TFP plays a crucial role in determining the growth of the agricultural production output in these countries. A positive TFP growth leads to a rise in the agricultural production output, while a decrease in TFP is associated with a tendency of stagnation in agricultural production output. The full list of sources of growth in the agricultural production output of OIC countries can be found in **ANNEX B**.

Agricultural Productivity and Competitiveness

Agricultural productivity measures the amount of production output produced (e.g., crops or livestock) given a set of resources and inputs (e.g., labour, land, water, and fertilisers) in the agriculture sector. To some extent, improving agricultural productivity is essential to boost economic growth and meet the growing demand for food as the population continues to grow (Gollin, 2010). Improvement in productivity is also an important factor for competitiveness in the global market. According to the Food and Agriculture Organization of the United Nations (FAO, 2017), when a country is able to increase its productivity, goods and services can be produced more efficiently and at a lower cost than its competitors. Moreover, productivity gains can also lead to increased wages and employment (Meager & Speckesser, 2011). All of these combined can lead to improved living standards and reduced poverty, which in turn can drive economic growth and development.

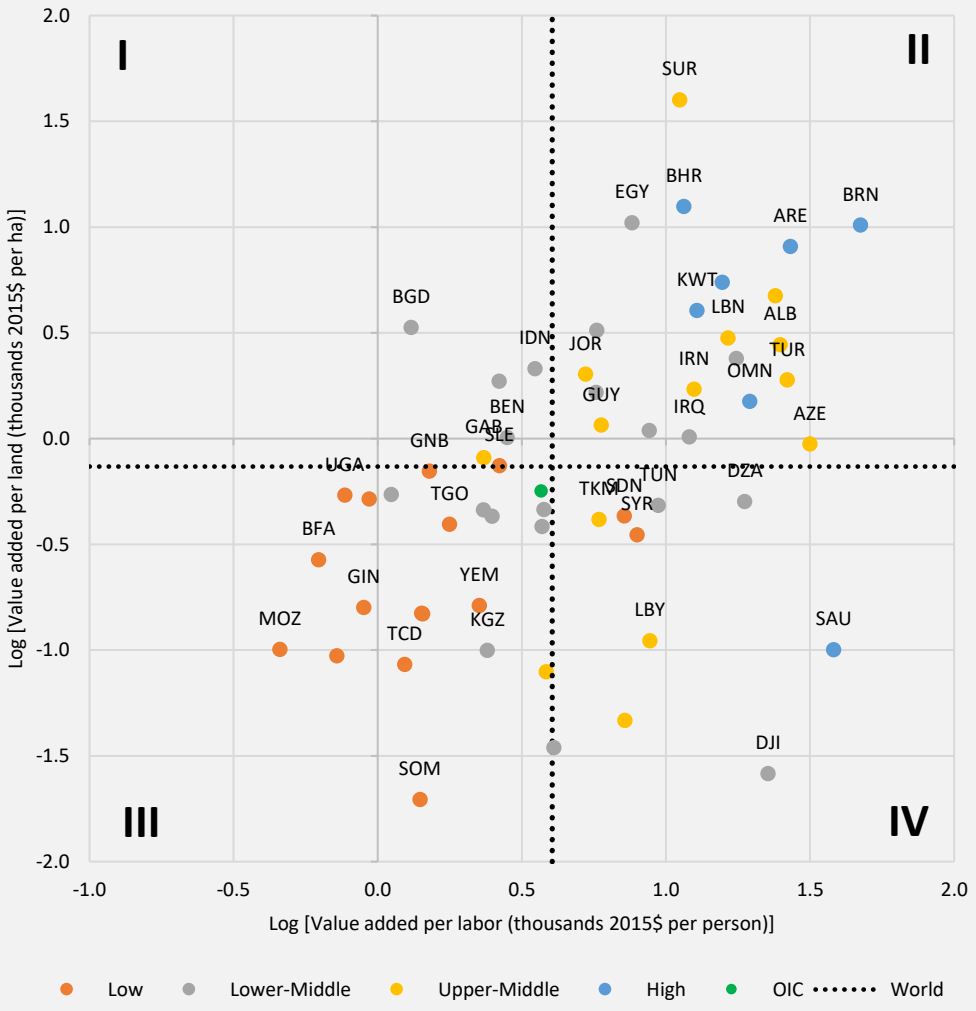
Land & Labour Productivity

Land and labour productivity are two crucial determinants of the overall productivity of the agriculture sector, as they reflect the efficiency with which each input is used to produce crops and livestock. Productivity of land is typically assessed in terms of "yield per hectare" or the amount of production output produced from one hectare of land. Labour productivity, on the other hand, measures the amount produced per unit of human labour in agriculture. This takes into account worker factors such as knowledge, skills, and competences, which can be improved through education, training, experience, and improved health (OECD, 2022).

When land and labour productivity are high, agricultural productivity is also high, and farmers are able to produce more production output with the same amount of land and labour. On the contrary, when land and labour productivity are low, agricultural productivity is also low, and farmers may struggle to produce enough production output

to meet the needs of the population. By comparing land and labour productivity across different agricultural operations and regions, it is possible to identify areas where productivity can be improved and evaluate the effectiveness of different farming methods, technologies, and policies.

Figure 2.4 **Agricultural Land and Labour Productivity, 3-year Avg. 2018-2020**



Source: Own calculation based on data from FAOSTAT.
Note: Based on 56 OIC member countries. Maldives is an outlier and is omitted from the graph. Income levels are based on World Bank income classification 2020. See **ANNEX A** for country classifications and codes.

To quickly compare land and labour productivity in OIC countries, a scatter plot matrix for the 3-year average 2018–2020 between labour and land productivity is presented in **Figure 2.4** (in logarithmic form). The countries are coloured depending on their income levels to show the income distribution of the countries. The plot is divided into four

quadrants based on the global average level of land and labour productivity. The 2015-dollar level was used in the calculation.

On average, OIC countries have a land productivity of US$ 0.6 thousand per hectare and a labour productivity of US$ 3.7 thousand per person. These levels are lower than the global averages for land and labour productivity, which are US$ 0.7 thousand per hectare and US$ 4.0 thousand per person, respectively. At the individual country level, more than half of OIC countries have land productivity levels below the world average, while 27 countries have labour productivity levels below the world average.

Furthermore, several conclusions can be drawn: First, the Maldives, Bahrain, Egypt, Brunei Darussalam, and the United Arab Emirates are the top five most land-productive OIC countries, while Libya, Kazakhstan, Mauritania, Djibouti, and Somalia are the least land-productive. Second, the most labour-productive countries are Brunei Darussalam, Saudi Arabia, Guyana, the United Arab Emirates, and Jordan, while the least labour-productive are Guinea, Uganda, Niger, Burkina Faso, and Mozambique. Third, the quadrants show a typology of land and labour productivity in OIC countries, where countries can be characterised as having productive land (quadrant I), productivity champions (quadrant II), traditional agriculture (quadrant III), and productive labour (quadrant IV). The complete list of countries based on this typology is presented in **Table 2.1**.

Table 2.1 Typology of Countries Based on Agricultural Land and Labour Productivity, 3-year Avg. 2018-2020

Quadrant	Description	Country List
I Productive Land	High land, low labour productivity	(6) Azerbaijan, Bangladesh, Indonesia, Pakistan, Benin, Sierra Leone
II Productivity Champions	High land, high labour productivity	(21) Maldives, Suriname, Malaysia, Lebanon, Albania, Jordan, Türkiye, Iraq, Guyana, Egypt, Comoros, Palestine, Nigeria, Uzbekistan, Iran, Bahrain, Brunei Darussalam, United Arab Emirates, Qatar, Kuwait, Oman
III Traditional Agriculture	Low land, low labour productivity	(20) Libya, Morocco, Senegal, Côte d'Ivoire, Kyrgyzstan, Tajikistan, Cameroon, Yemen, Togo, Guinea-Bissau, Afghanistan, Mali, Somalia, Chad, Gambia, Guinea, Uganda, Niger, Burkina Faso, Mozambique
IV Productive Labour	Low land, high labour productivity	(10) Gabon, Turkmenistan, Kazakhstan, Algeria, Tunisia, Mauritania, Djibouti, Sudan, Syria*, Saudi Arabia

* Syria is currently suspended from OIC membership.

Fourth, productivity levels are highly related to income levels, with the majority of countries with the lowest productivity (Quadrant III) coming from low-income countries. The countries in Quadrant III are the ones needing special attention since the low productivity levels might have repercussions on overall agricultural production, food security, and the socioeconomic development of the country. On the contrary, the most

productive countries (Quadrant II) are mostly upper-middle and high income countries. These countries can be leaders in agricultural productivity, set examples, and show best practises to other countries in order to improve the levels of agricultural productivity. Finally, countries in quadrants I and IV need to either catch up in land or labour productivity.

Appropriate government policies can help shaping the outcome of the agricultural productivity. For example, the Bangladesh government in 1999 launched the National Agricultural Policy with the goal of transforming the country's agriculture sector into a modern, efficient, and market-oriented system. The policy emphasized the need to increase land productivity through the adoption of improved agricultural technologies, irrigation, and the use of quality seeds and fertilizers. In Uzbekistan, agricultural productivity has increased by implementing policies that improve the efficient use of land and water resources, strengthen the technical capabilities of rural farmers, and enhance agricultural market regulation mechanisms (Narinbaeva et al., 2021).

It is important to note that rising agricultural productivity can be attributed to a number of factors, including improvements in technology, education, market access, and environmentally responsible farming methods. For example, the use of fertilisers and other methods for enhancing soil quality is strongly correlated with increased land productivity, while mechanisation of farming is commonly linked to increased labour productivity. In general, a higher quality of living and a more robust economy are the results of increased land and labour productivity (Chang et al., 2006). A country with low land and labour productivity may find it difficult to compete in international markets, leading to a weaker economy.

Gaining Ground on Agricultural Productivity

Resources Endowment

Agricultural productivity depends heavily on natural resource endowments, particularly water, land, and soil quality. The availability and quality of these resources are crucial determinants of the potential for agricultural production and the sustainability of agricultural systems over time.

In terms of land availability, the amount of land for cultivation can limit the potential for crop production. In regions with limited land resources, enhancing agricultural productivity often requires using land more efficiently through techniques like crop rotation, intercropping, and precision agriculture (Abegunde et al., 2019). Additionally, preserving land through conservation practices, like reducing deforestation and preventing soil erosion, can help maintain the productivity of agricultural systems over time.

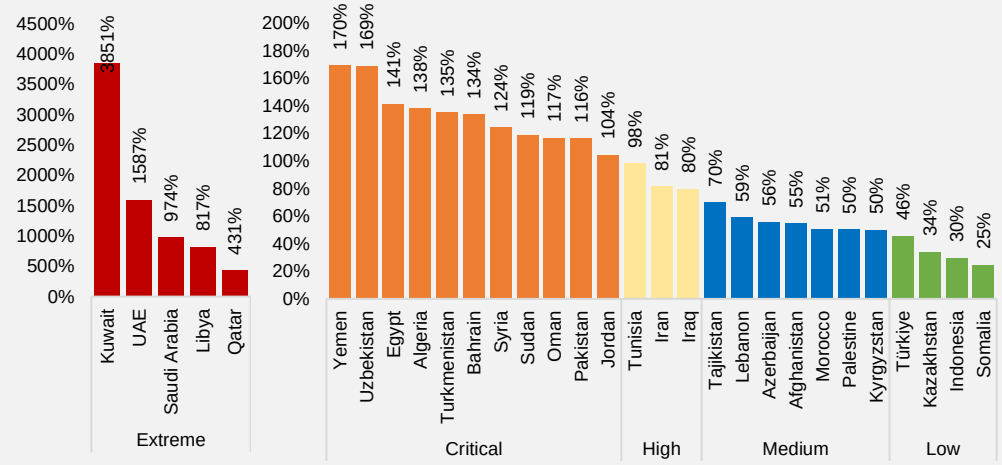
Water is another critical resource for agriculture, as crops require water for growth and survival. Adequate water availability is essential for plant growth, photosynthesis, and the formation of seeds and fruits. Variations in water availability can significantly influence crop yields and the stability of agricultural systems. For instance, water scarcity can result in drought conditions, causing crop failure and reduced yields. On the other

hand, excess water can lead to waterlogging and soil salinization, both of which can negatively affect crop growth and yields. Therefore, an optimal balance of water resources is essential to ensure optimal agricultural productivity.

The water stress indicator is a measure of water availability for both the environment and society, indicating the water security of a region. High water stress impedes environmental sustainability and can negatively affect socio-economic development and food security due to water competition. The OIC region faces a water stress level of 33.5%, higher than the global average of 16.7%. At the country level, 30 OIC member countries experience water stress, with 11 of them being in critical stress levels and five countries in extreme stress levels (see **Figure 2.5**). Therefore, countries with limited water resources should adopt sustainable water management techniques, including efficient irrigation, water conservation, soil management, and crop selection, to maintain agricultural productivity.

Soil quality is also crucial for agriculture, as it provides essential nutrients and physical support to crops. Soil characteristics such as texture, structure, organic matter content, and nutrient availability all contribute to determining the productivity of agricultural systems. Soil degradation due to erosion, overuse, or poor management can reduce soil fertility and lower agricultural productivity. Additionally, soil degradation can reduce the ability of soil to retain water, leading to waterlogging, soil salinization, and decreased crop growth (Jie et al., 2002).

Figure 2.5 Water Stress in OIC Countries, 2020



* Syria is currently suspended from OIC membership.
Source: FAO AQUASTAT database.
Note: FAO and UN Water (2021) defined water stress into five categories: <25% = No stress; 25-50% = Low stress; 50-75% = Medium stress; 75-100% = High stress; >100% = Critical stress. Due to some OIC member countries poses considerably extreme water stress level, we defined new category of 'Extreme stress' at higher than 200% level.

Land degradation is a major threat to biodiversity and agricultural productivity in OIC countries and elsewhere. From 2000 to 2015, approximately one-fifth of the Earth's vegetated land surface experienced persistent and declining trends in productivity, primarily due to poor land and water management (UN, 2020), equivalent to around 2,600 million ha of degraded land. In contrast, the OIC Environment Report (SESRIC, 2021b) highlights that 16% of the land area in the OIC is degraded, equivalent to around 500 million ha of degraded land. At the country level, four countries have alarming levels of land degradation (land degradation of over 50%), namely Tajikistan (97%), Bangladesh (65%), Kuwait (64%), and Benin (53%). Except for Bangladesh, these are countries with the majority of dry land. Further land degradation would result in desertification.

Land degradation is not solely caused by nature but also by human activity. Unsustainable agricultural practices, rapid urbanization, weak land governance, and expansion of agricultural areas have led to uncontrolled land-use change, contributing to land degradation. In Tajikistan, for instance, severe land degradation occurred due to inappropriate land management practices, poor irrigation, overgrazing, and deforestation. These factors combined have resulted in land abandonment and loss of productivity, intensifying rural poverty in the country (UNDP-UNEP, 2012). To ensure optimal agricultural productivity, soil resources must be managed sustainably through practices like conservation tillage, cover cropping, and the use of organic matter inputs.

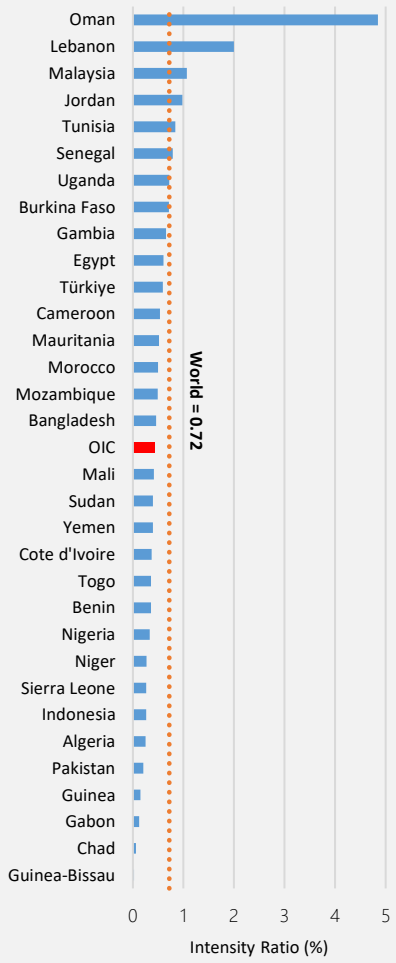
Agricultural Research and Development

Research and development (R&D) is a critical driver of growth in agricultural productivity. As new technologies and farming practices emerge, it is essential for farmers to stay informed and up-to-date in order to maximize their agricultural productivity and efficiency, while contributing to sustainable agriculture and food security. Various stakeholders, including governments, private industries, and international organizations, are increasingly investing in R&D to develop new technologies and innovations that can contribute to increased agricultural productivity.

The agricultural R&D intensity ratio (IR) is a useful indicator to compare the level of agriculture R&D spending between countries and regions. It measures agricultural research spending as a percentage of agricultural gross domestic product (GDP). The United Nations and African Union recommend that agricultural research spending should be at least 1% of agricultural GDP. However, globally, agricultural research spending falls short of this threshold, with a global IR of 0.7% in 2016. For comparison, high income countries had an average IR of 2.8%, while China, Brazil, and India had an IR of around 0.6%, 1.8%, and 0.3%, respectively (Beintema et al., 2020).

In 2016, OIC countries had an average intensity ratio of 0.4%, far below the recommended target and the global average. However, there has been an improvement in OIC's average IR over the past decade, increasing from 0.3% in 2007. **Figure 2.6** shows the IR of OIC countries in 2016, with only seven member countries recording IR higher than the world average level. Three OIC countries surpassed the 1% recommended threshold level, namely Oman (4.8%), Lebanon (2.0%), and Malaysia

Figure 2.6 Agricultural R&D Intensity Ratio, 2016



Source: SESRIC staff calculations based on ASTI database

(1.1%). Lebanon and Oman also significantly increased their IR, 4.7 and 1.3 times, respectively, compared to the 2007 levels.

Despite the high importance of the agriculture sector in the economy, developing countries, in particular, lack investment in agricultural R&D (Beintema et al., 2020). Agricultural research capacity depends on various factors such as the size of the economy, the importance of the agriculture sector in the overall economic system, and the level of development of the country. Underinvestment is relatively larger among countries with small- and medium-sized research systems (i.e. IR less than 0.3%), which usually have limited potential to improve their research capacity in the short term. Therefore, cooperation between countries with similar characteristics of the agricultural system can be beneficial and foster the development of the agricultural research system of the country.

Fostering Investment to Increase Productivity

Investment is a key factor in improving agricultural productivity and meeting the increasing demand for food. By fostering investment, governments can support the development of new technologies and practices, improve access to finance, and promote innovation, leading to higher yields, reduced costs, and increased efficiency. With the right investment and support, agriculture has the potential to be a major driver of economic growth and food security.

To encourage investment in the agriculture sector, several important strategies can be used. The private sector can provide critical funding and technical expertise to support agricultural development. Governments can create policies that are favourable to private sector investment, like tax breaks, and create a stable environment for businesses to operate. Moreover, it can be difficult for small farmers to get financial support. Governments can help by providing financial assistance, like loans and insurance, to enable farmers to invest in their farms. This can be done through microfinance and other financial services. Finally, research and development (R&D) is important for developing

new technologies and practices to improve agriculture. Governments can support R&D by investing in research institutions and encouraging collaboration between public and private sectors. This will also encourage innovation, such as developing new technologies and business models to improve productivity and competitiveness. Financial and non-financial incentives, like grants and awards, can also support innovation.

BOX B Initiatives to Boost Agricultural Productivity in Oman

Oman is a country that has historically relied on oil exports for the majority of its revenue, but it is increasingly looking to diversify its economy. The agriculture and fisheries sector is being supported by targeted investments in technology and research, as the government seeks to diversify the economy and feed a growing population. In 2016, production rose by 4.3% for agriculture and 8.7% for fisheries to 1.87 million and 280,000 tonnes, respectively. While Oman is limited in the types of products it can make commercially viable because of its arid climate, soil salinity and water scarcity, the country is leveraging technology to find new ways to grow its industries. Several notable initiatives are as follows:

- **Research & Development**: The government of Oman has invested in research and development in agriculture. Notably in 2011, the government established The Research Council (TRC) as an independent body with the mandate to build Oman's research capacity and encourage innovation in both agricultural and non-agricultural science sectors. This has helped to improve the quality of crops and to develop new crop varieties that are better suited to the local climate.

- **Introduction of Modern Farming Techniques**: Ranges of initiatives are being pursued to substantially raise productivity through the modernisation of existing crop technologies. The government is also developing small-scale integrated agricultural production by allocating 50,000 plots to citizens and small to medium-sized businesses for cultivation. Each plot is to be divided into segments, including open-field growing of climate-resilient crops, greenhouse production of less-resilient fruits and vegetables, and aquaculture using recycled irrigation water.

- **Climate Adaptation & Resilience**: Oman is taking measures to address water scarcity by exploring desalination technology and seawater greenhouse technology to reduce freshwater usage. The Middle East Desalination Research Centre and the Korea Agency for Infrastructure Technology Advancement signed a memorandum of understanding to collaborate on seawater desalination technology. Oman is also conducting government-supported field trials and feasibility studies by installing smart water meters at farms and monitoring groundwater usage through a centralized online management system to regulate water usage and rein in aquifer depletion. The use of these technologies could have implications for other countries facing similar water scarcity issues.

- **Agro-industry Support**: Oman is investing in agricultural production and processing of poultry, dairy, and beef to enhance its food security. Subsidiaries of the Oman Food Investment Company (OFIC) are carrying out projects at a total cost of OR270m ($701.1m) to boost local production. OFIC aims to deliver local halal products at a reasonable price by implementing "least-cost production" models, enhancing food security, and creating new wealth and jobs.

Source: Oxford Business Group (2018)

In order to tailor action plans and investments effectively, it is important to consider the specific conditions and needs of each OIC member country, and particular focus should be given to middle- and low- income countries where productivity has been declining in the past decade. One way to improve the productivity of agricultural inputs is by focusing on land productivity and assessing land quality. High-quality land is fertile, well-drained,

and supports healthy plant growth, resulting in increased yields and higher land productivity. In contrast, poor land quality, such as depleted soil nutrients, poor soil structure, or waterlogging, can reduce crop yields and lower land productivity.

Investments in different areas can increase land productivity. Soil fertility management, irrigation, drainage, land conservation, precision agriculture, crop rotation, and climate-smart agriculture are some areas where investment can be made to increase land productivity. For instance, investing in soil fertility management practices like fertilization, liming, and organic matter management can enhance soil health and increase land productivity. Similarly, irrigation infrastructure investment, such as wells, pumps, and pipelines, can improve water management and crop yields.

On the other hand, labour productivity in farming is influenced by the practices of the farmer. Traditional farming practices can result in low labour productivity due to the lack of modern technology and equipment, as well as limited access to education and training in modern farming techniques. Traditional farming methods often rely on manual labour, which is less efficient than using modern farming equipment. Furthermore, small farm sizes in traditional farming lead to less economy of scale and lower labour productivity.

To increase agricultural labour productivity, three basic levers can be used (SESRIC & ICD, 2022). First, providing financial assistance and training to farmers to modernize and optimize their operations through the implementation of mechanical and automation technologies. Second, integrating innovative and technologically advanced solutions into the agriculture sector can improve productivity and foster linkages between urban and rural areas, appealing to a younger generation with a keen interest in technology and data-driven practices. Last, fostering cooperative structures and collective bargaining mechanisms among farmers can result in increased farm revenues, improve competitiveness and attractiveness of the sector, and help to attract and retain talent in the sector.

Furthermore, limited infrastructure poses significant challenges to efficient agricultural production and distribution. Inadequate transportation networks and storage facilities hinder the smooth flow of agricultural products, ultimately impeding productivity in the sector. Moreover, poor infrastructure restricts farmers' access to markets, leading to post-harvest losses and limiting their profitability. Without proper infrastructure, farmers face difficulties in transporting their produce to consumers, which can have negative impacts on both the quantity and quality of agricultural goods available in the market. Addressing infrastructure gaps is crucial for improving agricultural productivity and ensuring that farmers can fully benefit from their work.

3 AGRO-FOOD INDUSTRIES AND FOOD SECURITY

Agricultural production in OIC countries has witnessed a remarkable surge. There has been an impressive 83% growth in agricultural production output in the past decades, reaching a substantial value of US$ 717 billion in 2020. However, agricultural production must be complemented by a well-developed agro-food industry to ensure food security, as it adds value to agricultural products, facilitates efficient distribution, creates employment opportunities, and promotes economic development.

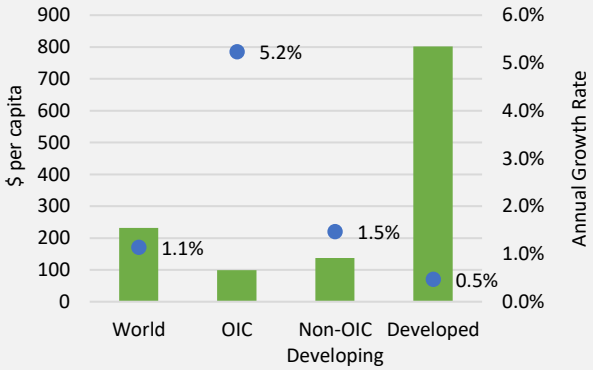
This chapter provides a comprehensive analysis of the state of agro-food industries in OIC countries, exploring their current status and key dynamics. Additionally, it explores the critical issue of food availability and its implications for food security within OIC member countries.

State of Agro-Food Industries

The agriculture sector and the food industry are mutually dependent and essential for ensuring food security and economic prosperity in a region. The agriculture sector supplies raw materials, which are then processed and transformed into food products by the food industry. On the other hand, the food industry provides crucial inputs to the agriculture sector, such as seeds, fertilizer, and machinery that help increase agricultural productivity and efficiency.

Over the years, the agro-food industry has become a major player in the manufacturing sector in many developing countries and has significantly contributed to their economic growth. This industry is responsible for activities that take place after harvest, such as the transformation, preservation, and preparation of agricultural products for intermediary or final consumption. Among the various components of agro-food industrial activities, the food industry is the most significant in both developed and developing countries. Unlike non-food agro-industries, the food industry is generally uniform and easier to classify because all of its products serve the same end-use purpose.

Figure 3.1 Food Industry Value Added (2020) and Annual Growth Rate (2012-2019), by Region



Source: Own calculations based on UNIDO, INDSTAT 2 - 2022 edition.
Note: Value added data according to ISIC Revision 3 at 2-digit level, division 15: Food and Beverages. OIC, non-OIC developing, developed, and World averages are calculated as a weighted average from a pool of 123 countries (including 30 OIC countries) with available data. Annual growth rate calculated as compound annual growth rate where year 2012 is the average of 2011-13 and year 2019 is the average of 2018-20.

Food Industry Development Level, Innovation, and Country Clusters

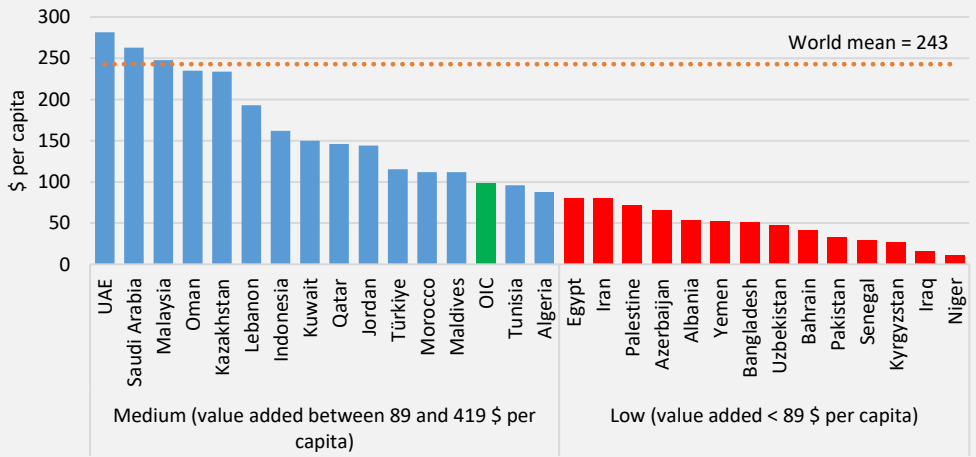
Analysing the development of agro-food industries is challenging for many developing countries, including OIC countries, due to data constraints. To address this issue, **Figure 3.1** compares the value added and growth of food industry in OIC countries with other regions using food & beverages industries classified in the United Nations Industrial Development Organization (UNIDO) database as a proxy. Value added per capita is used to indicate the level of development of the food industry and its contribution to the economy. OIC countries have a per capita value added of US$ 90, lower than the world average (US$ 243), non-OIC developing countries (US$ 131), and developed countries (US$ 800), indicating a lower level of food industry development. However, the food industry in OIC countries has demonstrated a faster growth rate than other regions, with

an annual growth rate of 5.2% over the past decade, compared to the global average of 1.1%, non-OIC developing countries at 1.5%, and developed countries at 0.5%.

A fast growth rate of the food industry indicates that the food sector is expanding and increasing its production, sales, and consumption. This growth is often a result of a strong and stable economy, increasing demand for food products, technological advancements, and government support (Borsellino et al., 2020). A fast growth rate is a positive sign that the food sector is thriving and can have a significant impact on the overall economy and standard of living in the region.

A quantile analysis was conducted to determine the level of development of the food industry in individual OIC countries. The analysis of 123 countries with available data showed that the bottom 25% (first quantile) of value added in the food industry was US$ 89 per capita, while the top 25% (third quantile) was US$ 419 per capita. Consequently, a low level of value added in the food industry was defined as less than US$ 89 per capita, a high level was defined as more than US$ 419 per capita, and a medium level was defined as any value in between.

Figure 3.2 Food Industry Value Added, 2020



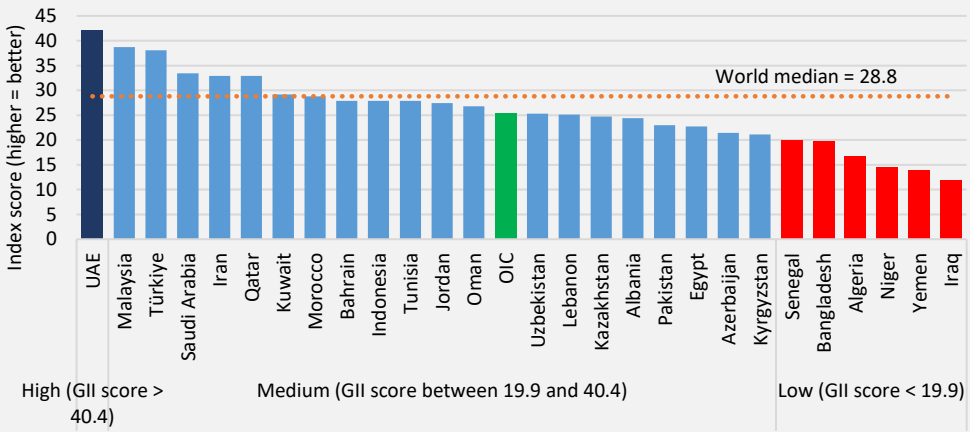
Source: Own calculations based on UNIDO, INDSTAT 2 - 2022 edition.
Note: Value added data according to ISIC Revision 3 at 2-digit level, division 15: Food and Beverages. The OIC average is calculated as a weighted average from data of 30 countries, while the world average is based on data from 123 countries with available data from the year 2020 or the most recent year after 2010.

Figure 3.2 indicates a significant disparity in the value added of the food industry among OIC member countries. OIC countries tend to have either low or medium levels of development, with most having value added below the global average. This suggests an overall underdeveloped state of the food industry in many OIC countries. The United Arab Emirates, Saudi Arabia, and Malaysia are the top three countries in terms of food industry value added per capita, while Niger, Iraq, and Kyrgyzstan have the lowest food industry value added per capita.

The food industry, which mainly depends on agricultural raw materials, possesses the ideal characteristics for many developing countries. Raw materials represent a significant portion of the total costs for the food industry, making them a crucial factor in its development. Despite the absence of proper infrastructure and skilled labour in some countries, the ready availability of raw materials at reasonable prices presents a tremendous opportunity for growth in the food industry.

Fully understanding the level of development of a food industry requires taking into account various factors, including the level of technology and innovation, the level of competition, and the quality of infrastructure and institutions. Technological innovations and advancements play a crucial role in enhancing the efficiency, quality, and competitiveness of manufacturing processes in the food industry (Najib & Kiminami, 2011). The level of innovation can serve as a key indicator of an industry's development as it reflects its ability to generate new ideas, enhance existing processes, and create new products and services.

Figure 3.3 Global Innovation Index, 2022



Source: Own calculations based on GII.
Note: OIC and World are median values. Based on 126 global economies (including 27 OIC countries) with available data.

To assess the level of innovation in OIC countries, Global Innovation Index (GII) data is used. GII is an annual ranking developed by the World Intellectual Property Organization (WIPO) and other institutions. This index assesses the innovation performance of 126 economies worldwide and provides valuable insights and a data-driven approach to comprehending the global state of innovation.

The analysis found that, on average, the innovation level of OIC countries is lower than that of the world. Furthermore, a quantile analysis using GII score resulted in cut points of 19.9 (first quantile) and 40.4 (third quantile), which were used as a benchmark to categorize countries into low, medium, or high innovation level. Accordingly, out of 27 OIC countries with available data, 20 were categorized as having a medium innovation

level, six as low, and one as high (**Figure 3.3**), with only the UAE meeting the criteria for high innovation. A high level of innovation indicates a dynamic and forward-thinking environment where businesses are constantly exploring new ways to enhance their operations and remain competitive, while a low level of innovation may suggest a lack of investment in research and development, resulting in a stagnant and less efficient industry (Shefer & Frenkel, 2005).

Three country clusters were formed based on the level of development and innovation in the agro-food industry to better tailor action plans and investment opportunities. This classification can provide a useful framework for understanding the relative competitiveness and potential of different food industries in different regions and can inform investment, trade, and technology policy decisions. The cluster of agro-food industries can be seen in **Table 3.1**.

Table 3.1 Agro-Food Industry Clusters in OIC Countries

Cluster	Description	Country List
Traditional Manufacturing	Low food industry development level, low innovation level	Bangladesh, Iraq, Niger, Senegal, Yemen
Emerging Manufacturing	Low to medium food industry development and innovation level	Albania, Azerbaijan, Bahrain, Egypt, Iran, Kyrgyzstan, Pakistan, Uzbekistan, Algeria
Advanced Manufacturing	Medium to high food industry development level and innovation level	Indonesia, Jordan, Kazakhstan, Kuwait, Lebanon, Malaysia, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, Türkiye, UAE

Countries in the first cluster, "Traditional Manufacturing," are characterised by a low agro-food industry development level and a lack of technological adoption. These countries might have considerable agricultural resources, but they generally lack the technological, financial, and institutional capacities to process agricultural raw materials into higher-value food products. The countries typically have a long and rich cultural heritage where food plays a significant role in society (Britwum & Demont, 2022). The industries are often dominated by small and medium-sized enterprises (SMEs), which are often family-owned and operated. These SMEs are important for local economies as they provide jobs and support local agriculture.

The second cluster, "Emerging Manufacturing," consists of countries that are in the early stages of agro-food industry development. They often have below-average productivity and limited infrastructure. Countries in this cluster have a low to medium agro-food industry development and innovation level. The third cluster, "Advanced Manufacturing," comprises countries whose agro-food industries are well established. Food productivity figures are typically higher than their peers' are, indicating a medium level of industry. These countries usually have strong supply chain networks and a high level of technology adoption.

Improvements in the agro-food industry environment will help transition from one cluster to another, which can play a crucial role in driving food security, economic growth, and

competitiveness. Governments can support this transition by implementing policies that encourage investment in new technologies and infrastructure, provide training and education opportunities for workers, and create a favourable regulatory environment for businesses.

Priority Sub-Sectors

Over the years of agro-food industry development, countries have become more specialised in certain products. Specialisation in specific products can happen through a combination of factors such as natural resource availability, infrastructure, investment, human capital, and government policies.

Table 3.2 illustrates the specialisation of the food industry in OIC countries based on the agro-food industry sub-sectors' contribution to total manufacturing value added. Overall, the majority of OIC countries are specialised in the 'Processed meat, fish, fruit, vegetables, and fats' sub-sector of the agro-food industry. Some countries have a greater than 20% contribution to total manufacturing value added, for instance, Palestine (20%), Indonesia (22%), Afghanistan (26%), Lebanon (27%), and Niger (41%). This indicates that the sub-sector is contributing significantly to the overall value added of manufacturing industries.

The contribution of the 'Dairy products' sub-sector is the most significant in Iraq, despite only contributing 1% of total manufacturing value added. In the 'Grain mill products, starches, and animal feeds' sub-sector, significant contributions are made in Bangladesh, Oman, and Pakistan. The sub-sector of 'Others: bakery, sugar, macaroni, chocolate, etc.' made an important contribution to total manufacturing in Azerbaijan, Brunei, Egypt, Iran, Jordan, Kyrgyzstan, Oman, Senegal, and Tajikistan.

Specialisation is one of the ways to achieve complementarity, where countries can focus on producing crops or livestock that are well suited to their resources and climates. This can lead to increased efficiency, reduced costs, and higher quality products that are more appealing to international buyers. Specialisation of a country can also help facilitate more successful trade negotiations, as both parties can better understand each other's needs and areas of expertise. It may present investment opportunities for businesses looking to tap into that market and help businesses and countries position themselves more effectively in global markets.

Improving Competitiveness of Agro-Food Industries

Many agriculture-based developing countries possess a natural comparative advantage in the global market for agro-food industrial products; however, they have not been able to capitalize on these advantages to foster competitive agro-food industrial and economic development. The rise of global markets based on competitive advantage has led policymakers to focus on assessing the "enabling environment" for agro-food industries.

Some of the reasons for uncompetitive agro-food industry are inadequate government spending on education, research and development, and infrastructure; non-conducive

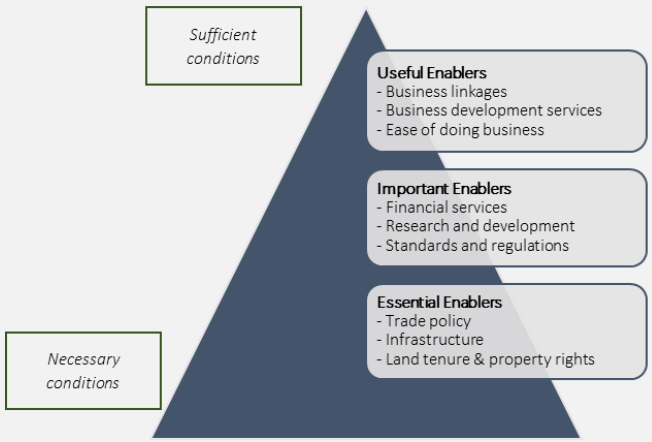
investment climate and trade policy; and poor access to technology. To develop a successful domestic and export-oriented agro-food industry, it is necessary to create a business environment and a supportive policy framework that fosters productivity (FAO, 2013). Developing a suitable mechanism at the national and regional level will enable developing countries to raise their competency in identifying, selecting, developing and utilizing modern and socially appropriate technologies so that they can maintain and improve their comparative advantage.

Table 3.2 Agro-Food Industry Contribution to Total Manufacturing Value Added

Country	Food Industry Sub-Sector			
	Processed meat, fish, fruit, vegetables, and fats	Dairy products	Grain mill products, starches, and animal feeds	Others: bakery, sugar, macaroni, chocolate, etc.
Afghanistan (2019)	26%			
Albania (2019)	8%	2%	2%	6%
Algeria (2015)	6%	0%	4%	
Azerbaijan (2019)	9%	4%	4%	9%
Bahrain (2016)	5%			
Bangladesh (2018)	2%	1%	6%	2%
Brunei (2019)	3%	0%	1%	5%
Egypt (2017)	5%	2%	5%	7%
Indonesia (2018)	22%	4%	2%	5%
Iran (2016)	4%	2%	2%	4%
Iraq (2019)	0%	1%	0%	
Jordan (2018)	7%	3%	2%	8%
Kazakhstan (2019)	4%	2%	3%	3%
Kuwait (2019)	1%	1%	1%	2%
Kyrgyzstan (2019)	2%	3%	1%	5%
Lebanon (2014)	27%			
Malaysia (2019)	13%	1%	1%	3%
Morocco (2019)	7%	3%	4%	6%
Niger (2016)	41%			
Oman (2018)	2%	0%	2%	2%
Pakistan (2016)	5%	2%	7%	6%
Qatar (2019)	0%	1%	0%	
Saudi Arabia (2018)	5%	2%	0%	2%
Senegal (2019)	8%	2%	8%	16%
Palestine (2019)	20%			
Tajikistan (2019)	2%	0%	7%	22%
Tunisia (2019)	12%			
Türkiye (2019)	5%	2%	2%	4%
UAE (2019)	6%			
Uzbekistan (2019)	5%	1%	3%	3%
Yemen (2013)	40%	0%		

Source: Own calculations based on UNIDO, INDSTAT 4 - 2022 edition, Rev. 3 and Rev. 4.
Note: Shaded cells indicate the food industry sub-sector with the largest contribution to the manufacturing sector of the country. "Processed meat, fish, fruit, vegetables, and fats" fall under the category of Division 151 of ISIC Rev. 3, as well as the sum of Division 1010, 1020, 1030, and 1040 of ISIC Rev. 4. "Dairy products" are classified under Division 1520 of ISIC Rev. 3 and Division 1050 of ISIC Rev. 4. "Grain mill products, starches, and animal feeds" belong to Division 153 of ISIC Rev. 3, and/or the sum of Division 106 and 1080 of ISIC Rev. 4. Finally, " Others: bakery, sugar, macaroni, chocolate, etc." are comprised of Division 154 of ISIC Rev. 3 and Division 107 of ISIC Rev. 4.

Figure 3.4 Enabling Needs for Agro-Food Industry Competitiveness



Source: Adopted from Christy et al. (2009).

The hierarchy of enabling needs presented in **Figure 3.4** outlines the actions that governments can take to promote economic progress in agro-food industries. The hierarchy divides state actions into three levels: essential enablers, important enablers, and useful enablers. Essential enablers include rule of law, infrastructure, and trade policy, while important enablers cover finance, transportation, and information. Useful enablers, such as grades and standards and business development services, are defined as sufficient but not necessary conditions (Christy et al., 2009).

The agro-food industries in many OIC countries face various challenges that affect their competitiveness. One significant issue is the inadequate food safety regulations and weak enforcement systems. The lack of proper quality control measures, certification processes, and adherence to international standards pose obstacles to market access and consumer trust. Without robust food safety regulations and effective enforcement, agro-food industries struggle to meet the stringent requirements of global markets, limiting their potential for growth and expansion.

In addition to food safety concerns, there is an issue of inefficient marketing and distribution systems. Fragmented supply chains, the lack of market integration, and inadequate market information contribute to higher transaction costs and impede the timely and effective distribution of products. These challenges not only affect the overall efficiency of the agro-food supply chain but also hinder the industry's ability to reach a wider consumer base and respond to market demands in a timely manner.

Furthermore, weak branding and marketing strategies also hinder the competitiveness of agro-food products from OIC countries. Limited branding efforts and insufficient marketing campaigns result in a lack of product differentiation and weak market positioning. Without a strong brand presence and effective marketing strategies, agro-

food industries struggle to compete in global markets and capture premium prices for their products. This lack of competitiveness further limits their ability to expand market share and maximize profitability.

Addressing these challenges requires concerted efforts from governments, industry stakeholders, and relevant institutions. Creating enabling needs for agro-industry to flourish, such as through strengthening food safety regulations, improving enforcement mechanisms, and promoting adherence to international standards can enhance market access and consumer trust. Investing in efficient marketing and distribution systems, including the integration of supply chains and the provision of accurate market information, can reduce transaction costs and facilitate the timely delivery of agro-food products. Additionally, developing robust branding and marketing strategies to differentiate products and promote their unique qualities can help agro-food industries from OIC countries overcome the barriers to competitiveness and achieve sustainable growth in the global marketplace.

Furthermore, SMEs in the food-processing sector can contribute significantly to local and rural development by introducing technical innovations, promoting entrepreneurship, and improving business practices. However, they face significant challenges such as adapting to a more competitive environment, scaling their operations, meeting quality standards, and adhering to regulations.

While private sector investment is crucial, the public sector can also facilitate agro-food industrial development by implementing innovative policies and institutions. Developing countries can identify and explore export market opportunities by developing their agro-food industry, despite barriers to trade. Integration into global agro-food markets is essential for success, but challenges remain in adhering to standards, ensuring quality consistency, meeting volume requirements, and timely delivery.

Brief Assessment of Food Security

Ensuring sufficient food production is a fundamental pillar in addressing global food security challenges. As the world's population continues to grow, it becomes increasingly vital to develop sustainable agricultural practices and enhance productivity to meet the rising demand for food. Achieving food security requires not only increasing overall food production but also addressing issues related to access, availability, and utilization. This interconnectedness between food production and food security highlights the need for comprehensive strategies and collaborative efforts to ensure a stable and nourished future for all.

Food security is defined by FAO as every individual having access to sufficient and nutritious food that meets his or her dietary needs for an active and healthy lifestyle. Today, countries around the world are recovering from the pandemic, however, patterns of food insecurity remain a challenge posing serious socio-economic difficulties. The eradication of hunger has taken a central stage in international strategic documents such as the Sustainable Development Goals and the OIC-2025 Programme of Action.

In many low and middle-income economies, such as those in Sub-Saharan Africa and South Asia, hunger and undernourishment – two key indicators of severe food insecurity – are on the rise. Whereas, in developed economies, such as those in Europe, the prevalence of obesity in adults and overweight children is growing. All of this is a direct result of food insecurity resulting from a combination of factors including, but not limited to, difficult economic conditions, weak commodity prices, lack of adequate infrastructure, poverty, conflicts, and adverse climatic conditions, that either prolong or worsen chronic and transitory food insecurity around the world.

Prevalence of Food Insecurity

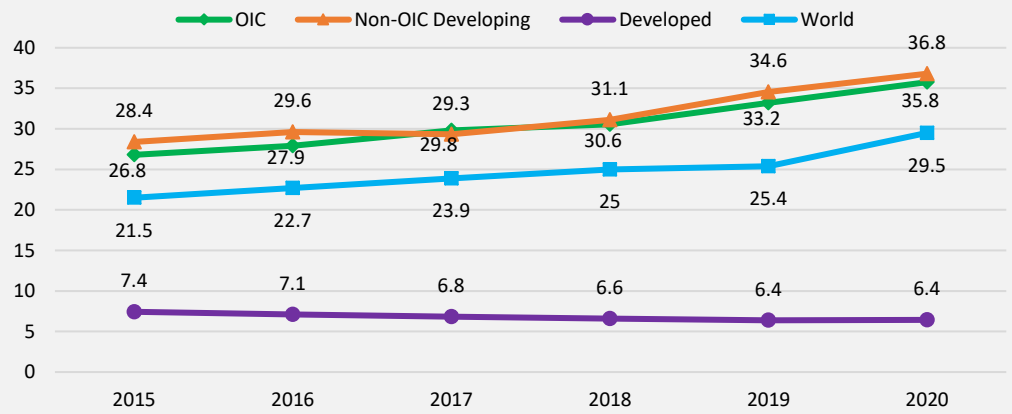
Food security is a crucial issue in the world, affecting millions of people every day. The World Food Summit (1996) defined food security as "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life."

The shocks of 2020 through 2022 have highlighted the invalidity of the global food system, putting food security concerns to the head. These more frequent and extensive shocks, such as covid-19, conflicts, extreme weather events, and assurgent costs are exacerbating the systemic issues that drive food security down and weaken the resilience of the system, especially in OIC member countries, with a high level of agro-food import.

According to the Global Report on Food Crisis (GRFC) 2022 (Global Network Against Food Crises & FSIN, 2022), around 42 million people in 37 countries are projected to have been malnourished and need urgent action. The food security situation in most of the OIC member countries remains to escalate. Afghanistan, Nigeria, Somalia, and Yemen remain at the highest alert level, as they all have populations facing or projected to face starvation. The alert is extended to the Syrian Arab Republic, Sudan, and Pakistan coupled with uncertainties of climate extremes and other conditions, such as food inflation, high fuel prices, and ripple effects of the situation in main cereal suppliers. The OIC member countries, which comprise 57 countries with a population of approximately 1.8 billion, are facing severe challenges in terms of food security. The challenges are exacerbated by a combination of factors such as poverty, conflicts, natural disasters, and climate change. One of the influences in the national/regional situation of food security in OIC is the level and movement of refugees, following the United Nations, an estimated 84 million people around the world were forcibly displaced by the midway point of 2021 and 8 from 10 top hosting countries of refugees are OIC member countries.

Moderate food insecurity is associated with the inability to regularly eat healthy, nutritious diets. Severe food insecurity refers to an insufficient quantity of food intake (calories) and is thus strongly related to undernourishment or hunger. Globally, an estimated 2.3 billion people were moderately or severely food insecure in 2020. Whilst the greatest numbers are seen in Sub-Saharan Africa and South Asia regions, moderate food insecurity is an issue even in developed countries.

Figure 3.5 Prevalence of Moderate or Severe Food Insecurity (%), 2015-2020



Source: Own calculations based on the United Nations Statistics Division (UNSD), Global SDG Indicators Database.
Note: (OIC: N = 42; Non-OIC Developing: N = 74; Developed: N = 33; World: FAO Estimates).

Proportions of people moderately or severely food insecure have been on the rise both in OIC and non-OIC developing countries and globally. Particularly since 2019, the outbreak of COVID-19 had a visible negative impact on food security. The prevalence of moderate or severe food insecurity has risen by 9 percentage points, from 26.8% to 35.8% of the total population, in OIC countries as a group, from 2015 to 2020 (**Figure 3.5**). Similarly, non-OIC developing countries' average also increased from 28.4% to 36.8%, over the same period. Whereas, developed countries as a group have achieved to decrease the prevalence of moderate and severe food insecurity from 7.4% to 6.4% since 2015. Furthermore, the pandemic had relatively less impact on developed countries compared to developing ones.

Political instability, combined with conflicts, famine, and economic recession has resulted in a decrease in food security in these countries leading to shortages in food supply and production. Similarly, in several member countries food production has been volatile in recent years mainly due to unpredictable shocks resulting from climate change such as floods, droughts and crop diseases.

Despite the significance it holds for OIC countries, there has been a lack of a comprehensive methodology to monitor the food security status of OIC member countries. Therefore, the development of a specific Food Security Index (FSI) for OIC countries becomes immensely crucial. In this context, the Islamic Organization for Food Security (IOFS) has taken the initiative to develop such an index, and the preliminary results can be observed in **BOX C**.

Drivers of Food Security Trends

Despite significant advancements in food production and distribution, millions of people around the world continue to suffer from hunger and malnutrition. The drivers of food

BOX C IOFS's Food Security Index (FSI)

The Islamic Organization for Food Security (IOFS) has developed a simple, understandable, and robust FSI model to measure the level of food security in member countries. It combines the methodologies of the Food and Agriculture Organization (FAO) and the World Food Program (WFP) to create a unique and comprehensive assessment of food security. The IOFS FSI model is essential for (1) providing member countries with a clear and concise understanding of their food security situation, enabling them to develop targeted policies and programs to address the challenges they face, (2) comparing the food security situation in different countries and identifying areas where further support is required, (3) assisting in promoting international partnerships to address food security challenges and enables member countries to work together to share knowledge and resources to improve their food security situation Its simplicity, comprehensiveness, and effectiveness make it an essential instrument for promoting food security and achieving sustainable development goals.

FSI includes three dimensions: weighing the food consumption, access, and nutrition based on the secondary data of UN FAOSTAT. The FSI of OIC member states has been calculated and presented in Table 3.1. This table depicts the converted simple index 1 to 3 (score 3-high food security, 2-marginal food security, 1-low food security) to reflect the situation of the countries regarding the Food Security Index (FSI). The FSI values were calculated by aggregating each country's weighted food item values, based on the Food Balance Sheet of the UN FAOSTAT (see **ANNEX D** for detailed methodology).

Initial Results of Food Security Index (3=high food security), 2019-2020

Country	Y2019	Y2020	Country	Y2019	Y2020	Country	Y2019	Y2020
Albania	3	3	United Arab Emirates	2	2	Nigeria	2	1
Kazakhstan	3	3	Côte d'Ivoire	2	2	Mali	1	1
Kuwait	3	3	Benin	2	2	Afghanistan	1	1
Türkiye	3	3	Iran (Islamic Republic of)	2	2	Bangladesh	1	1
Uzbekistan	3	3	Maldives	2	2	Chad	1	1
Bahrain	3	3	Gabon	2	2	Comoros	1	1
Qatar	3	3	Malaysia	2	2	Djibouti	1	1
Algeria	2	2	Mauritania	2	2	Gambia	1	1
Azerbaijan	2	2	Cameroon	2	2	Guinea-Bissau	1	1
Egypt	2	2	Syrian Arab Republic	2	2	Iraq	1	1
Guyana	2	2	Lebanon	2	2	Jordan	1	1
Kyrgyzstan	2	2	Niger	2	2	Mozambique	1	1
Libya	2	2	Burkina Faso	2	2	Senegal	1	1
Morocco	2	2	Guinea	2	2	Sierra Leone	1	1
Oman	2	2	Indonesia	2	2	Suriname	1	1
Saudi Arabia	2	2	Pakistan	2	2	Togo	1	1
Tunisia	2	2	Tajikistan	2	2	Uganda	1	1
Turkmenistan	2	2	Sudan	2	2	Yemen	1	1

Note: The countries with higher ranks indicate the internal situation of food security based on 3 dimensions consumption, access, nutrition, and readiness of the countries to meet the basic needs to cover internal demand for food. The IOFS understands the limitation of calculated indexes, as there are a lot of opinions on including different dimensions, however, it shows the internally available sources of the countries. The high index affirms the issues of safety, quality, and adequacy of the food supply and dietary intake, as well as relationships among food intake, nutrition, and access to it.

security are complex and multifaceted, encompassing a range of factors that impact food availability, access, utilization, and stability. With the world population projected to reach 10 billion by 2050, ensuring food security for all is becoming increasingly challenging. In addition, changes in food prices, largely driven by shifts in demand and supply, have significant implications for food security. Climate change, with its unpredictable and

extreme weather patterns, can also exacerbating food insecurity. Understanding these drivers and their complex interplay is crucial for developing effective strategies to address food insecurity and ensure a sustainable food future. This chapter explores these drivers of food security and their interplay, highlighting the need for a holistic and integrated approach to addressing the issue of food security.

Population Growth

There is a high risk of insufficient food and agricultural products output due to an increase in demand for food that cannot be satisfied by an adequate supply. This could be a result of the rapidly expanding population.

It is estimated that the world population to exceed 8.5 billion by 2030 and to continuously increase –though at a significantly reduced rate– to reach 10 billion in the second half of the 2050s (SESRIC, 2021b). The population of developed countries, growing at a rate already as low as 0.26 percent in the last 5-year period of 2015-2020 is expected to enter a declining trend after the mid-2030s. Thus, almost all of the population growth until the mid-2030s and all further growth is expected to occur in the developing world.

In the OIC countries, the population has doubled in 33 years and exceeded 1.9 billion in 2020, accounting for 24.5 percent of the global population. Although the population growth rate is declining in the OIC as well, these ratios are estimated to rise by 26.3 percent by 2030 and to increase even further in the following years (SESRIC, 2021b). With these in mind, statistics show that developing countries and OIC countries in particular have been growing at much faster rates than developed countries in the last two decades, and this trend is expected to continue in the decades to come.

Consequently, this high-growth performance requires more attention to be paid to its food security reflections in the coming years, with the aim of providing sufficient and healthy food for the population while at the same time minimising the negative impacts on human health and on the environment.

In the years to come, it will be necessary for the farmers in the OIC to produce an extra quantity of food. This will be challenging as the OIC continues to be a net importer and more than half of its population still cannot afford a healthy diet. Climate change could also make it more difficult to find natural resources, particularly in areas where there is insufficient land or water for agricultural and food production to be viable. Meeting these challenges would require dramatic changes must be made to food production and consumption while keeping the agriculture sector productive and sustainable.

Changes in Food Prices and Availability

The lingering effects of the COVID-19 pandemic continue to exert inflationary pressure on foods and are contributing to a mixed picture of economic recovery among countries. At the same time, geopolitical instability, conflicts, and insecurities play a significant role in inciting an economic downturn. This, in turn, may have negative repercussions on food security.

The conflict in Ukraine is currently aggravating the situation by interrupting supply chains and influencing global food markets. First, the price of staple commodities such as wheat and cereals rose significantly. Russia and Ukraine are both substantial exporters of wheat. When export routes are restricted, food supplies become limited and prices go up. The war has also disturbed supplies of fertiliser from Russia, which was the biggest exporter in the world. This is made worse by the rising price of gas, which is needed to make fertiliser.

Second, Western countries adopted severe sanctions against Russia, which impeded free trade and led to the return of protectionism. In addition, disruptions in the oil supply shook global markets, resulting in an increase in oil prices, which was followed by a quick rise in food costs. Thirdly, these supply-side variables invariably result in demand-side repercussions; as food costs rise, it becomes more difficult for individuals to afford agricultural items. Demand inevitably declined. Obviously, poorer regions are more severely affected than wealthy countries.

Conflict-induced economic downturns are projected to have the greatest detrimental effect on food security in OIC countries. During the ongoing crisis, many people lost their jobs or had their incomes drastically reduced, which will push some households into poverty and threaten overall food security. The population that suffers a loss of income is at risk of not being able to afford their daily food needs. This situation is exacerbated by the increased cost of food as a result of a supply disruption. Member countries that rely substantially on food imports may be at a higher risk. Shock to international trade and currency exchange fluctuation could hamper the food stock, rising local prices, and threatening food security even more. In Sudan for instance, amid the fight to control the COVID-19 outbreak, the prices of various staple foods have increased to record highs in March following a further devaluation of the country's currency (FAO, 2020).

It is projected that the trend of economic decline would persist through 2022 and beyond. Global growth is anticipated to fall from 6.0 percent in 2021 to 3.2 percent in 2022 and then to 2.7 percent in 2023, while global inflation is projected to increase from 4.7 percent in 2021 to 8.8 percent in 2022 before declining to 6.5 percent in 2023 (IMF, 2022). However, due to their distinct production and trade structures, as well as the varying rates of economic recovery, consumer food price increases are anticipated to vary significantly between regions. The current situation demonstrates how crucial it is for nations to create self-sufficient and sustainable agricultural systems. To achieve this, OIC countries, notably the least developed ones, must reform their agricultural systems.

Climate Change and Environmental Factors

The present vulnerabilities of food insecurity and malnutrition due to the crisis are further pressured through the compound impacts of climate change on the agro food systems. In fact, climate change is already contributing to reduced food security and nutrition and will continue to do so through its direct and indirect impacts on all four dimensions of food security: agricultural production (availability), access to food (sufficient income), utilization (nutrition, quality), and stability.

Impacts of the climate change on food availability relates to the supply side of food, from the farmers level all the way to food processing, supply and distribution of foods. Agriculture, as the primary sector of food production, is highly vulnerable to the adverse impacts of global climate change since higher temperatures, lower precipitation levels, CO2 concentration, and extreme climatic events (such as drought or floods), can lead to reduced crop yields or even crop failures.

Climate change may also have negative impacts on access to food. Access to food relates to income and the ability of individuals to acquire sufficient food and nutrition. During the COVID-19 crisis, access to food is the main source of food insecurity in many OIC countries, notably due to the loss of jobs and income in the midst of the COVID-19 pandemic. In the case of climate change, people working in the agriculture sector, as well as the most vulnerable part of society, is highly at risk of not being able to access sufficient food.

Furthermore, increased extreme events may disrupt agricultural trade and transportation infrastructure. Climate change has caused increasingly unprecedented extreme weather conditions and natural hazards during the past decades. According to the latest data from the Centre for Research on the Epidemiology of Disasters (CRED), the number of natural disasters globally increased from 3,374 in 1992–2001 to 3,802 in 2012–2021, with a peak of 4,300 in 2002–2011. A similar trend is happening in OIC countries. The number of natural disasters has increased from 820 in 1992–2001 (24 percent of the global total) to 911 in 2012–2021 (26 percent of the world total), peaking at 1,114 occurrences of disasters in 2002–2011 (24 percent of the world total). The rising number of natural disasters in OIC countries was driven by climate-related disasters such as floods, earthquakes, storms, wet mass earth movements, and droughts, suggesting a clear link to climate change. These disasters have caused major economic and human losses. Between 1992 and 2021, around 600 million people in OIC countries were impacted, with more than half a million mortalities and over $200 billion in economic damage.

4 TRADE COMPLEMENTARITY OF AGRICULTURE COMMODITIES

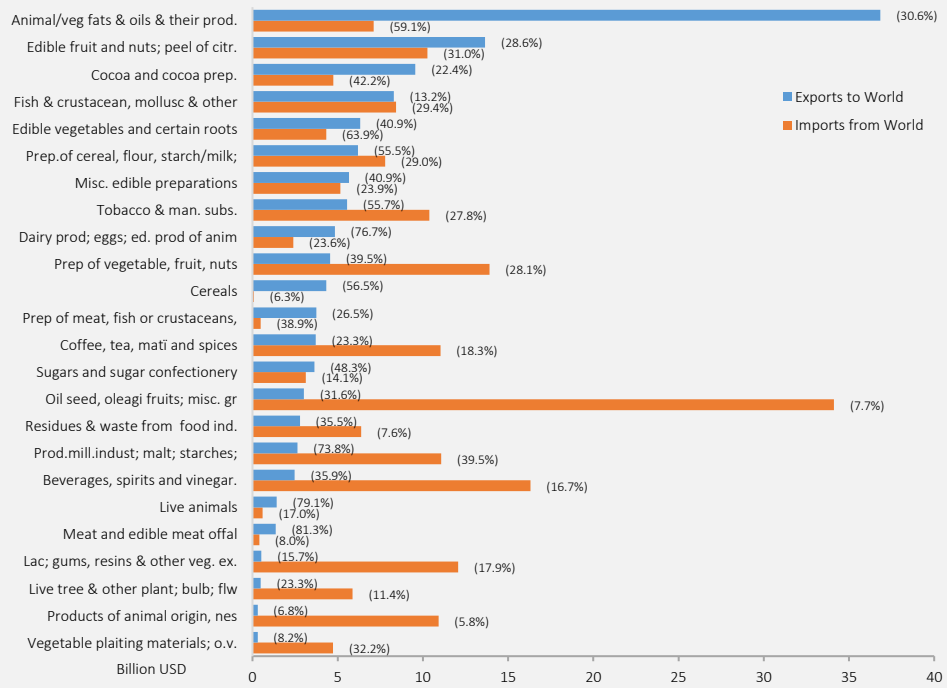
Despite rapidly growing technologies, agriculture remains one of the most strategically important sectors for the world economy. While its trade plays an important role in the sustainability of global food systems and reducing food insecurity, it also provides many raw materials for other related industries and manufacturing. It is critically important for achieving the goal of ending hunger by 2030, as enshrined in the SDGs. Growth in the global population, rising commodity prices, higher income levels in developing countries, and policies towards liberalisation of agricultural trade have been driving the rise in agricultural trade over the past decades. According to FAO (2019), the value of global agricultural and food trade flows has increased five-fold in the last three decades. The monetary value of global food exports increased from around US$ 380 billion in 2000 to around US$ 1.4 trillion in 2019, reflecting more than threefold growth in nominal terms (FAO, 2021).

In the light of global developments, this chapter discusses the recent trends and developments in the structure of agricultural trade, along with a review of trade policies and potential avenues for partnership among OIC countries. The data has been averaged over periods of five years to account for possible fluctuations in agricultural production and trade over time.

Sectoral Trade in Agriculture

With an annual average of over US$ 132 billion worth of exports and over US$ 191 billion worth of imports during 2016-20, OIC countries, as a group, remain a net importer of agricultural products. Classified based on Harmonized System (HS), a standardised numerical method of classifying traded products, **Figure 4.1** shows the total exports and imports of OIC countries in broad categories of agriculture-related products (at a 2-digit classification level). 'Animal and vegetable fats and oils' is the top export product category, with an average export value of US$ 36.8 billion, 30.6% of which are exported within the OIC. It is followed by 'Edible fruit and nuts' (US$ 13.7 billion, 28.6% of which intra-regional) and 'Cocoa products nuts' (US$ 9.6 billion, 22.4% of which intra-regional). 81.3% of 'Meat and edible meat offal', 79.1% of 'Live animals', and 76.7% of 'Dairy products, eggs, and products of animals' were exported to other OIC countries, reflecting strong intra-regional trade relationships in these products.

Figure 4.1 Total Agricultural Exports and Imports of OIC Countries (Billion US$, Annual Average during 2016-20) and Intra-OIC Trade (%, in parenthesis)



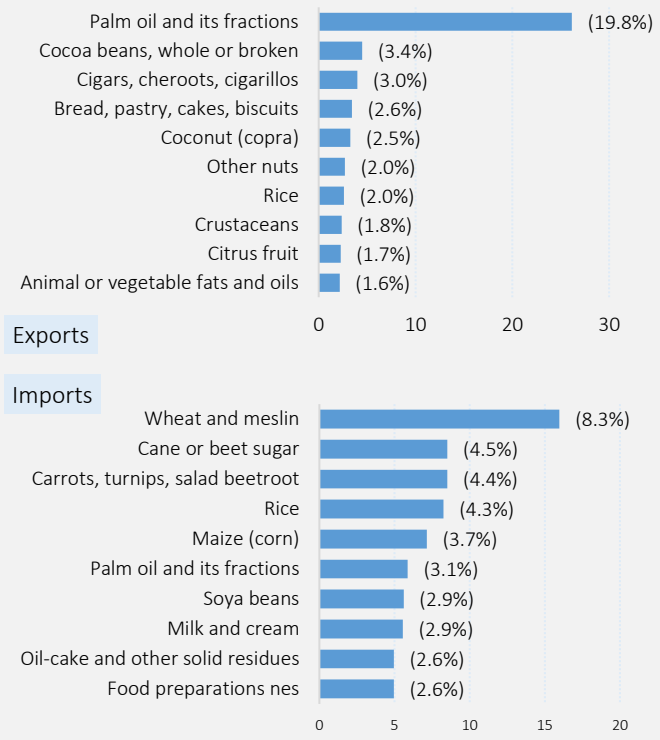
Source: World Bank & UN WITS database based on UN COMTRADE data.
Note: Share of product in total agricultural trade are provided in parenthesis.

In terms of imports, the agricultural products with the highest import value are classified under the category of 'Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder', with an average annual value of imports over US$ 30 billion, of which only 7.7% are imported from other OIC countries.

It mainly involves 'Palm oil and its fractions'. The other major product categories with the highest import values are 'Beverages, spirits and vinegar' (US$ 16.3 billion) and 'Preparation of vegetable, fruit, and nuts' (US$ 13.9 billion). On the other hand, products with the highest share of intra-OIC import are 'Edible vegetables and certain roots' (63.9%), 'Animal and vegetable fats and oils' (59.1%) and 'Cocoa products' (42.2%).

At a more disaggregated level (4-digit product level), the top agricultural products exported and imported by OIC countries are presented in **Figure 4.2**. With a significantly high share of 19.8% and a value of US$ 26.5 billion in exports, 'Palm oil and its fractions' constitutes the major agricultural product exported by OIC countries to the world. 'Cocoa beans, whole or broken' (3.4%) and 'Cigars, cheroots, cigarillos' (3.0%) come next with around US$ 4-4.5 billion in exports. Moreover, the top imported agricultural product is 'Wheat and meslin' with an annual average import value close to US$ 16 billion, representing 8.3% of all agricultural imports of OIC countries.

Figure 4.2 Top Agricultural Products Exported and Imported by OIC Countries (Annual Average during 2016-20, US$ Billion)



Source: World Bank & UN WITS database based on UN COMTRADE data.
Note: Share of product in total agricultural trade are provided in parenthesis.

At the intra-regional level, 'Palm oil and its fractions' once again tops the list of agricultural products exported by OIC countries within the region, with a share of 16.6% in total agricultural exports. It is followed by 'Cigars, cheroots, cigarillos' (5.2%) 'Bread, pastry, cakes and biscuits' (3.9%), 'Wheat and meslin' (3.4%) and 'Rice' (2.6%). The top five products constitute almost one-third (32%) of agricultural exports among OIC countries.

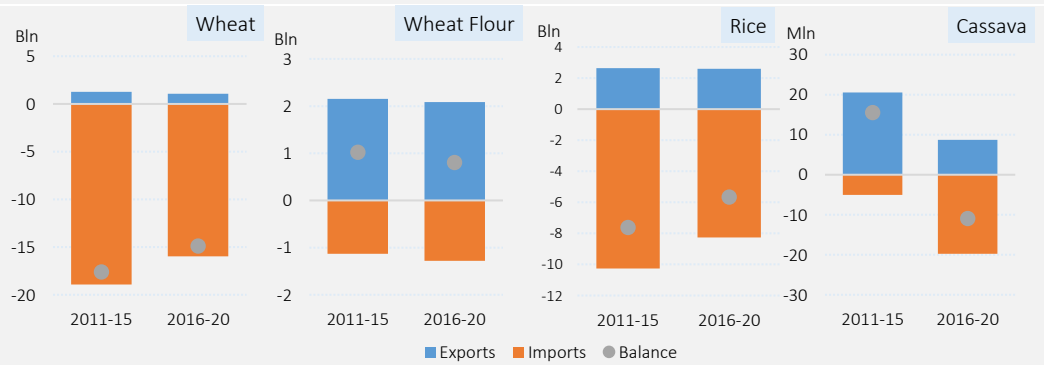
Trade in Strategic Commodities

Due to their critical importance in food security and nutrition, wheat, rice, and cassava are considered by OIC countries as the three strategic agricultural products in their intra-regional cooperation during the Eighth OIC Ministerial Conference on Food Security and Agricultural Development, which was held in Istanbul, Republic of Türkiye during 25th-27th October 2021. In this connection, this subsection will review the major trends in exports and imports of these products with a view to providing some guidance on devising policies related to the production and trade of these products.

OIC countries are heavily dependent on imports of wheat. During 2011-15, they collectively exported US$ 1.3 billion worth of wheat, but imported US$ 18.9 billion worth of wheat per annum, resulting in an average annual trade deficit of US$ 17.6 billion. During 2016-20, annual export of wheat declined to US$ 1.1 billion, but imports also fell to US$ 16.0 billion, reducing the deficit to US$ 14.9 billion. However, it should be noted that wheat is not being imported solely for internal consumption. Some OIC countries, including Türkiye and Kazakhstan, are major wheat processors, which consequently export significant amounts of wheat flour. As a result, OIC countries demonstrate significant trade surplus in wheat flour, which reached US$ 806 million during 2016-20 (**Figure 4.3**).

Similar to wheat, OIC countries are net importer of rice, with an average annual deficit of US$ 7.6 billion during 2011-15 and US$ 5.7 billion during 2016-20. On average, they export around US$ 2.5 billion and import US$ 11-13 billion per annum. The total value of trade in cassava is relatively low, but there is a trend reversal. While OIC countries were net exporter of cassava with an average annual trade surplus of US$ 15 million during 2011-15, they turned to be a net importer during 2016-20 with an average trade deficit of over US$ 10 million. Yet, compared with wheat and rice, trade in cassava remains trivial (**Figure 4.3**).

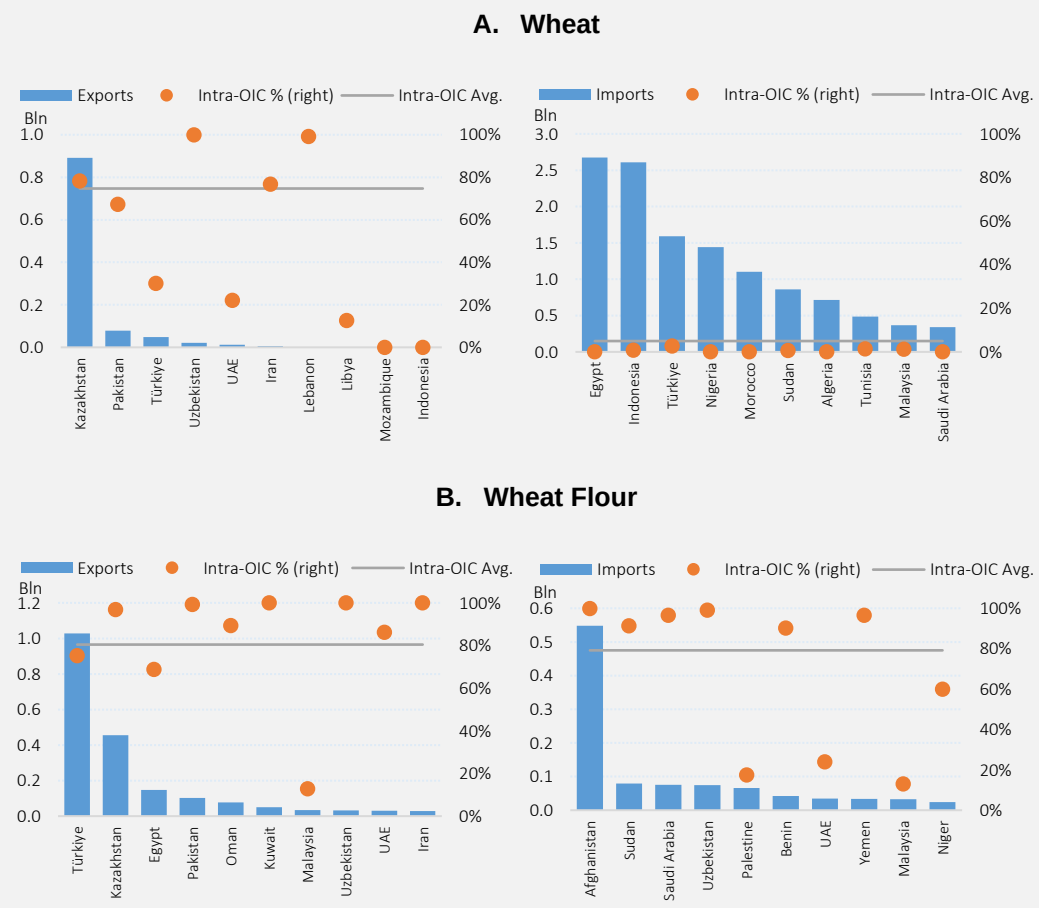
Figure 4.3 Exports, Imports and Trade Balance in Strategic Commodities in OIC Countries (annual average, US$)



Source: World Bank & UN WITS database based on UN COMTRADE data.

At individual country level, Kazakhstan is by far the biggest exporter of wheat (US$ 891 million), with 78.4% of the total exported to other OIC countries. On average, 74.7% of wheat is exported by OIC countries to other OIC countries, representing strong linkages in wheat trade. Egypt, Indonesia, Türkiye, Nigeria, and Morocco are the major importers of wheat, but on average, OIC countries import only 5% of the wheat they need from other OIC countries (**Figure 4.4/A**). In terms of wheat flour, Türkiye is the largest exporter with an average annual value of exports over US$ 1 billion, followed by Kazakhstan with over US$ 450 million in exports. On average, OIC countries export 80.4% of their wheat flour exports to other OIC countries. Similarly, intra-OIC wheat flour imports account for 79.2% of total wheat flour imports, demonstrating significant economic connectivity in terms of wheat flour trade among OIC countries (**Figure 4.4/B**).

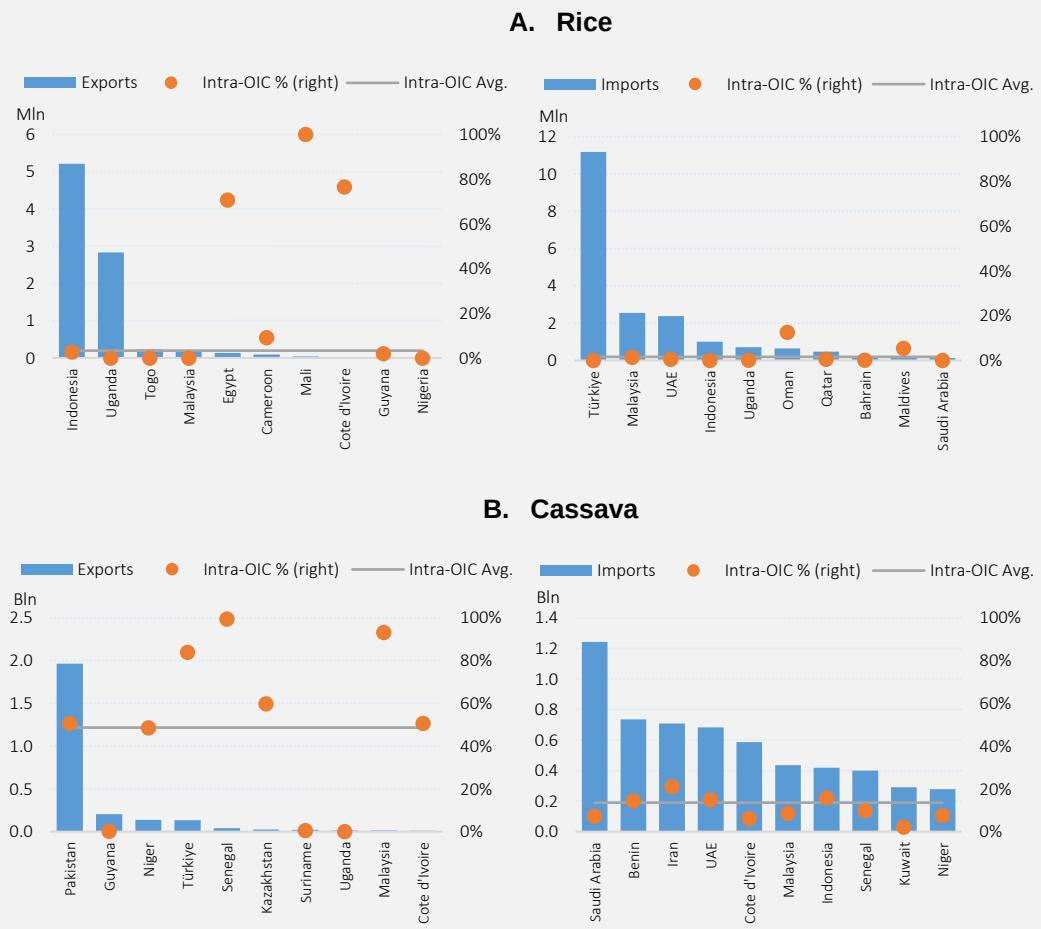
Figure 4.4 Total Exports, Imports and Share of Intra-OIC Trade in Wheat and Wheat Flour, 2016-2020 Average



Source: World Bank & UN WITS database based on UN COMTRADE data.

Pakistan is the main exporter of rice within the OIC region, representing 75% of total OIC rice exports. However, its exports to OIC countries account for only 50.5% of Pakistan's total rice exports. On average, only 48.6% of the rice exported by OIC countries is traded intra-regionally. On the other hand, OIC countries import only 13.5% of their rice from other OIC countries, where Saudi Arabia, Benin and Iran are among the top importers of rice (**Figure 4.5/A**). This presents opportunities for OIC countries to trade more among themselves in this specific product.

Figure 4.5 Total Exports, Imports and Share of Intra-OIC Trade in Rice and Cassava, 2016-2020 Average



Source: World Bank & UN WITS database based on UN COMTRADE data.

With regard to cassava, Indonesia and Uganda are the two major exporters, but they export almost exclusively to non-OIC countries. Total exports of the other OIC countries in the top 10 exporters list are rather insignificant. Among the importers, Türkiye appears to be the top importer, followed by Malaysia and United Arab Emirates. Yet again, the

import share of OIC countries in total cassava imports is only 1.6%, reflecting the absence of any significant trade relations among OIC countries in cassava trade (**Figure 4.5/B**). Even though the underlying rationale on the strategic importance of cassava is not obvious, there exist opportunities for OIC countries to trade more with each other in this product.

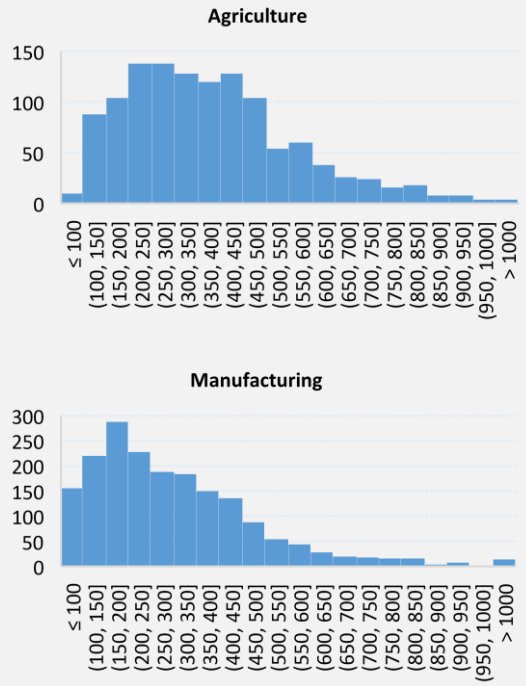
Overall, OIC countries are net importers of the three strategic products, demonstrating the need for improving capacities and productivity in these products. Yet, in wheat flour, OIC countries managed to be a net exporter thanks to the investments made in wheat processing in certain countries, most notably in Türkiye and Kazakhstan. While improving agricultural productivity is crucial, investments should also be made to enhance domestic capacity to process primary agricultural products.

Tariffs and Trade Costs in Agricultural Trade

Trade barriers and trade costs are among the important determinants of regional integration, where higher tariff rates and transport costs hinder economic cooperation among countries. By its nature, trade costs and protectionism have been higher in agricultural products than in manufacturing products. A comparison of bilateral trade costs among OIC countries in agricultural products and manufacturing products reveals that trade costs in agricultural products are higher. There are hundreds of country pairs within the OIC region whose bilateral trade costs in agricultural products are above 300% in ad valorem terms, indicating that cross-border trade among many OIC countries is at least three times more costly than their domestic trade (**Figure 4.6**). High trade costs in food and agriculture can offset the influence of comparative advantage and prevent the growth of trade even in the presence of significant complementarities.

In fact, this situation is not limited to OIC countries only. These costs are high in many parts of the world due to the bulk and perishability of food and the high costs of compliance with non-tariff measures such as sanitary and phytosanitary

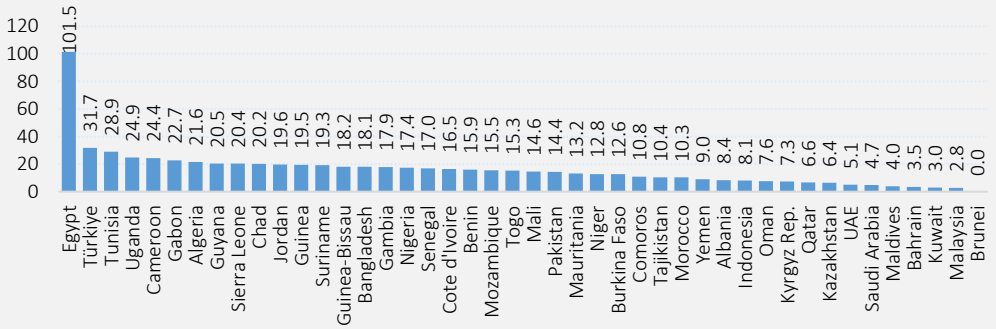
Figure 4.6 Bilateral Trade Costs in Agricultural and Manufacturing Products



Source: World Bank & UNESCAP Trade Costs database.
Note: Horizontal axis show the range of bilateral trade costs and vertical axis shows the number of country pairs for the corresponding range of trade costs.

standards (FAO, 2022). The fall in transport costs and tariffs over the last few decades was among the main drivers of rising globalisation, which helped boost global value chains and regional integration. Yet, this trend is relatively slow for agricultural products.

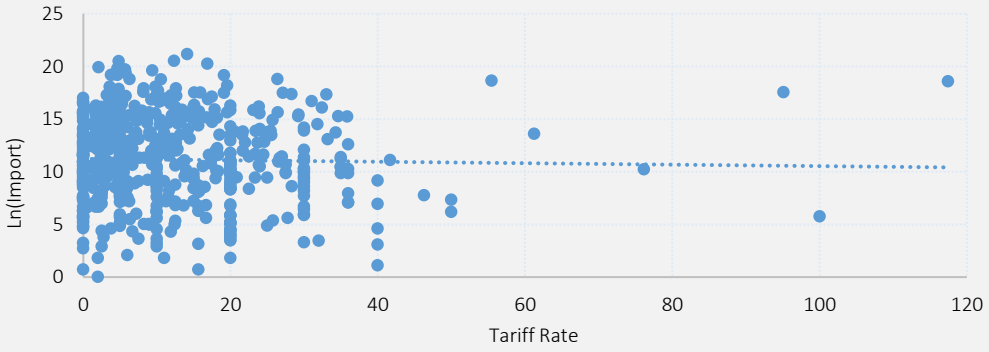
Figure 4.7 Effectively Applied Tariffs on Agricultural Products in OIC Countries, Latest Year Available



Source: World Bank & UN WITS database based on WTO IDB data.
Note: Simple average of tariffs applied by individual OIC country for the latest year data available after 2015.

Figure 4.7 shows the simple average of applied tariffs on agricultural products by OIC countries for the latest year with available data after 2015. Simple averages could be misleading, but weighted average data, which are usually much lower, are not available for majority of OIC countries. In this connection, Egypt appears to be the OIC country with the highest tariff rates, exceeding 100%, yet the weighted average for Egypt is 21.9%. Together with Egypt, 20 OIC countries apply tariffs over 20% level in terms of simple averages. On the other hand, Brunei Darussalam does not apply any tariffs on agricultural imports. Additionally, five other OIC countries apply less than 5% tariffs on agricultural imports, including Malaysia, Kuwait, Bahrain, Maldives and Saudi Arabia.

Figure 4.8 Bilateral Tariffs on Agricultural Products and Imports in OIC Countries (Latest year available)



Source: World Bank & UN WITS database based on WTO IDB data.

A graphical analysis on the relationship between agricultural tariffs and imports does not provide a clear association between the two variables (**Figure 4.8**). It is difficult to argue that higher imports are associated with lower tariff rates, which intend to provide protection for local farmers. Trade openness usually considered an important factor in improving productivity and competitiveness in international markets. As also evidenced in the literature, (FAO, 2022) stresses that increasing productivity, lowering tariff barriers and reducing trade costs can increase the gains from trade. However, in countries with low agricultural productivity, trade openness could entail losses, especially for those smallholder farmers who are not able to increase their efficiency and compete in more open markets. Complementary policies will be needed to reduce inequalities that may arise by improving access to technology and resources.

Comparative Advantages and Complementarity among OIC Countries

The global economy is being increasingly organised around the global value chains (GVCs) as a result of fragmentation of production processes across countries. However, agricultural trade offers limited opportunities for participation in GVCs, mainly due to perishable nature of many agricultural products. Still, the global value added generated by agriculture, forestry and fishing grew by 73% in real terms between 2000 and 2019, reaching US$ 3.5 trillion in 2018 (FAO, 2021). Agricultural activities constitute a significant share of overall economic activities in many OIC countries in Africa. With effective policies towards increasing their productivity in products that they have comparative advantage in, they may attain higher gains from growing regional and global economic interconnectedness.

A standard tool in international trade is to assess comparative advantages of individual economies. Comparative advantage refers to ability of a country to produce goods and services at a lower opportunity cost than other countries. Having a comparative advantage is not the same as being the best at something. However, it gives an opportunity for a country to sell goods and services at a lower price than its competitors and realize more gains. The theory of comparative advantage provides a strong argument in favour of free trade and specialisation among countries.

A standard measure for measuring a country's comparative advantage is the Balassa's revealed comparative advantage (RCA) measure. The RCA compares the share of a product in a country's total exports with the share of this product in world exports. It shows whether the country has a relative advantage (RCA > 1) or disadvantage (RCA < 1) in exporting the goods. Competitive advantage is what makes an economy more competitive than its rivals because of cost advantages.

Table 4.1 shows the list of products for which OIC countries have comparative advantages, ranked according to the number of countries having the comparative advantages. It also lists the top three OIC countries with the highest RCA scores for each product. Based on the United Nations Conference on Trade and Development (UNCTAD) calculations using 2021 trade data, 28 OIC countries have comparative advantages in fruits and nuts. OIC countries are also particularly strong in terms of

vegetables, spices, cotton, wheat flour, and fish, for which at least 20 OIC countries have comparative advantages. Regarding the strategic products, 11 OIC countries have comparative advantages in rice and only 3 OIC countries have comparative advantages in wheat.

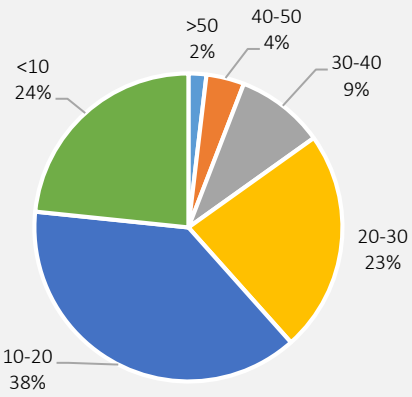
Table 4.1 Agricultural Products with Highest Number of Countries with Comparative Advantages

Products	No of Countries	OIC Countries with Highest Value of RCA		
Fruits and nuts (excluding oil nuts)	28	Guinea-Bissau	Afghanistan	Gambia
Vegetables	24	Sudan	Afghanistan	Morocco
Spices	24	Comoros	Afghanistan	Sudan
Cotton	24	Benin	Tajikistan	Sudan
Meal and flour of wheat and meslin	23	Syria*	Djibouti	Kazakhstan
Fish	20	Maldives	Mauritania	Yemen
Crustaceans, mollusks and invertebrates	19	Mauritania	Gambia	Senegal
Sugar confectionery	18	Togo	Palestine	Syria*
Sugar, molasses and honey	17	Uganda	Guyana	Yemen
Fish, dried, salted or in brine; smoked fish	16	Maldives	Uganda	Guyana
Oil seeds & oleaginous fruits (incl. flour, n.e.s.)	16	Djibouti	Benin	Burkina Faso
Live animals	14	Somalia	Sudan	Djibouti
Fish, aqua. invertebrates, n.e.s.	14	Maldives	Somalia	Morocco
Cereal preparations	14	Palestine	Türkiye	Lebanon
Other cereal meals and flour	13	Uganda	Djibouti	Yemen
Vegetables, roots, tubers, n.e.s.	13	Syria*	Lebanon	Albania
Fruit and fruit preparations	13	Albania	Djibouti	Lebanon
Coffee and coffee substitutes	13	Uganda	Côte d'Ivoire	Yemen
Tea and mate	13	Uganda	Yemen	Afghanistan
Feeding stuff for animals	13	Mauritania	Sudan	Benin
Margarine and shortening	13	Indonesia	Syria*	Tunisia
Oil seeds and oleaginous fruits (excluding flour)	13	Sudan	Niger	Benin
Milk and milk products (excluding butter, cheese)	11	Uganda	Djibouti	Syria*
Rice	11	Guyana	Pakistan	Suriname
Edible products and preparations, n.e.s.	11	Senegal	Palestine	Egypt
Cereals (excl. wheat, rice, barley, maize)	9	Uganda	Sudan	Cameroon
Cocoa	9	Côte d'Ivoire	Cameroon	Sierra Leone
Chocolate, food preparations with cocoa, n.e.s.	8	Lebanon	Côte d'Ivoire	Palestine
Cheese and curd	6	Bahrain	Kyrgyzstan	Egypt
Silk	6	Uzbekistan	Tajikistan	Kyrgyzstan
Maize (not including sweet corn)	4	Uganda	Yemen	Djibouti
Meat, edible meat offal; flours, meals	3	Pakistan	Gambia	Palestine
Butter and other fats and oils from milk	3	Kyrgyzstan	Uganda	Yemen
Wheat and meslin	3	Djibouti	Kazakhstan	Syria*
Barley	3	Kazakhstan	Syria*	Jordan

*Syria is currently suspended from its OIC membership.
Source: UNCTADSTAT database.

Another useful index is the trade complementarity index (TCI), which measures the extent to which two countries are “natural trading partners” in the sense that what one country exports overlaps with what the other country imports. In calculating the TCI, we

Figure 4.9 Trade Complementarity in Agricultural Products



Source: Author's calculation based on UN COMTRADE database based on 2016-2020 trade data.

used only agricultural products classified under HS Codes 1 to 24 (see **ANNEX C** for the description of the products). In order to avoid time-specific fluctuations, the calculations were made using the five-year averages of trade data between 2016 and 2020. Since there are more than two thousand observations calculated for each country pair within the OIC, the TCI values are shown in **Figure 4.9** in aggregated terms.

Accordingly, only 2% of country pairs within the OIC have trade complementarity in agricultural products over 50%. Another 4% has TCI values between 40% and 50%. In total, only 15% of country pairs within the OIC have a complementarity index score over 30%, which is relatively low. 62% of country pairs have complementarity below 20%. This implies that there are not strong trade opportunities among many OIC countries in terms of complementarities in agricultural products.

Table 4.2 Pair of OIC Countries with Highest Complementarities in Agricultural Trade (2016-20)

Importer	Exporter	TCI	Import ('000 USD)	Importer	Exporter	TCI	Import ('000 USD)
Albania	Cameroon	62.8	166	Yemen	Kazakhstan	55.0	0
Benin	Guyana	59.3	4	Albania	Türkiye	54.3	44,928
Sierra Leone	Pakistan	59.0	24,495	Niger	Pakistan	53.8	20,640
Benin	Pakistan	56.3	29,534	Kazakhstan	Türkiye	52.9	42,388
Tajikistan	Kazakhstan	56.2	287,794	Uganda	Niger	51.5	6
Albania	Cote d'Ivoire	56.0	203	Afghanistan	Yemen	51.4	0
Sierra Leone	Guyana	55.5	0	Kyrgyz Rep.	Türkiye	50.0	6,918

Source: Author's calculation based on UN COMTRADE database using 2016-2020 trade data.
Note: Import value indicates the average annual imported agricultural products during 2016-20 as reported by importing country.

Table 4.2 shows the country pairs where the level of match between exporting and importing agricultural products from OIC countries is the highest. For example, the export supply of Cameroon matches the import demand of Albania by 62.8%. It is 59.3% between Guyana and Benin and 59% between Pakistan and Sierra Leone. Even if there are significant complementarities among some OIC countries, agricultural trade between these countries is almost non-existent. This is largely due to the distance between the paired countries. For Benin or Sierra Leone, for example, it should be rather costly to import from Guyana, especially when the products are of a perishable nature. On the other hand, Tajikistan imports significant quantities of agricultural products from Kazakhstan. Similarly, Albania and Kazakhstan imported from Türkiye over US$ 40 million worth of agricultural products per year during 2016-20, where geographical proximity enabled stronger trade relations among these countries.

5 CONCLUDING REMARKS

OIC member countries exhibit diversity in terms of their agricultural development and food security, specifically regarding agricultural resource-use efficiency, food production and agro-food industry development, as well as agro-food trade. The analysis of the report has highlighted the strengths and weaknesses of these countries in different areas, demonstrating a considerable potential for OIC member countries to collaborate and leverage their efforts to enhance food security and economic development in the Muslim world.

To achieve this objective, member countries can complement each other by sharing their knowledge and best practices, as well as facilitating trade and investment in various areas of cooperation that may benefit them. For instance, countries with high productivity in resource-use can share their agricultural expertise with other countries in need, while countries with advanced technology and know-how in agro-food industries can support other member countries in enhancing their agricultural value chains.

Moreover, the role of OIC institutions is crucial in facilitating and coordinating joint efforts towards these goals. Various OIC institutions can play important roles in promoting agricultural development and food security among member countries. Their work includes financing projects, conducting research and data collection, promoting standards and certification, and facilitating economic cooperation and trade in the food and agriculture sectors.

Potential Areas of Cooperation

The agricultural productivity is essential for economic growth and competitiveness in the global market. While OIC countries have seen an increase in agricultural production output over the past decades, the growth has been primarily driven by an increase in inputs rather than by gains in productivity, which could have negative implications for overall agricultural production, food security, and socioeconomic development. There are notable differences in land and labour productivity among OIC countries, with more than half of OIC countries having land productivity levels below the world average and 27 countries having labour productivity levels below the world average. The analysis in this report categorizes OIC countries into four quadrants based on their land and labour productivity levels and income levels, with the most productive countries typically being upper-middle and high-income countries, and the least productive countries being low-income countries. The varied nature of this diversity presents opportunities for collaboration in different areas, which member countries could explore to enhance their agricultural productivity.

The agro-food industry is responsible for the transformation, preservation, and preparation of agricultural products for consumption after harvest. The food industry, in particular, is the most significant component of agro-industrial activities. Although OIC countries, on average, have a per capita value added of $90, the lowest compared to other regions, they demonstrated a faster growth rate of 5.2% annually over the past decade. This growth is a positive sign that the food sector is thriving and can significantly influence the overall economy and standard of living in the region.

Technological innovations and advancements play a crucial role in enhancing the efficiency, quality, and competitiveness of manufacturing processes in the food industry. However, the analysis found that, on average, the innovation level of OIC countries is lower than that of the world. The level of innovation can serve as a key indicator of an industry's development as it reflects its ability to generate new ideas, enhance existing processes, and create new products and services. In this respect, OIC countries can improve cooperation, sharing knowledge to enrich the innovation level and overall development of food industry.

At the same time, encouraging food industry means promoting value addition to agricultural products. Value addition increases the value and marketability of products, reduces post-harvest losses, stimulates rural economies, and enhances food security. Moreover, it fosters technological innovation, knowledge transfer, and the development of skilled labour within the agro-industry sector. OIC member countries can leverage their agricultural resources by prioritizing value addition and processing efforts to achieve sustainable economic growth, create employment opportunities, and strengthen their position in the global market.

Even if some OIC countries remain net exporters of certain agricultural products, OIC countries are collectively net importers of agricultural products. As noted by SESRIC (2020), OIC countries, as a group, were able to expand their international trade capacities in agricultural products over time as a result of rising productivity and product

diversity and falling trade barriers. The existing disparities across OIC countries and sub-regions in terms of international trade in agricultural products could be considered as a window of opportunity to enhance intra-OIC agricultural trade. However, the analyses in this report reveal limited opportunities for complementarity of trade and higher intra-OIC cooperation in agricultural trade. There are still significant tariff and non-tariff barriers, diminishing the prospects for higher trade. In this connection, instead of focusing on enhancing intra-OIC trade in raw agricultural products, more emphasis could be given to improving capacities to process them and export the products with greater value added. This would help to improve domestic production capacities and productivity, and enhance competitiveness in global markets. As discussed earlier, there is already a good practice in which OIC countries are net exporters of wheat flour even if they are a net importers of wheat.

The issue of trade is closely intertwined with the trade facilitation measures. It is a critical issue that demands attention which aimed at simplifying trade procedures, reducing non-tariff barriers, and harmonizing standards and regulations to ensure the smooth flow of agricultural products among member countries. One key aspect of trade facilitation is streamlining customs procedures. OIC countries can work together to simplify and standardize customs processes, reducing bureaucratic delays and paperwork requirements. This would expedite the clearance of goods at border crossings, enhancing efficiency and reducing costs for traders. Furthermore, the implementation of modernized customs systems, such as electronic data interchange and risk management techniques, can improve transparency and facilitate trade documentation processes.

Improving border infrastructure is another crucial element of trade facilitation. Investments in transportation networks, border facilities, and logistical infrastructure can enhance connectivity and facilitate the movement of agricultural products. Upgrading and expanding ports, roads, and railways can reduce transit times and costs, ensuring timely delivery of goods to markets. Additionally, establishing efficient border crossing points equipped with modern facilities and advanced technology can streamline border clearance procedures and enhance trade efficiency.

Finally, harmonizing standards and regulations is also essential to facilitate trade among OIC member countries. By aligning technical regulations, product standards, and conformity assessment procedures, trade barriers related to divergent requirements can be minimized. This harmonization process not only simplifies trade procedures but also fosters greater confidence and trust in the quality and safety of agricultural products. Establishing common certification mechanisms for halal food products is particularly important, as it ensures uniformity and credibility in halal certification processes, promoting trade in this significant market segment.

The overall assessment of the comparative advantages and complementarity of agricultural resources, food production, and trade in OIC countries in this report has pointed out to 13 potential areas of cooperation. These have been grouped into four crosscutting themes: finance, research and extension services, governance, and rural development and resources quality improvements, and are outlined in **Table 5.1**. By

engaging in cooperation between various stakeholders, including governments, the private sector, NGOs, and international organizations, OIC member countries can realize more efficient resource utilization, enhance food production, and promote trade in the agro-food industry. This collaborative approach has the potential to yield significant benefits for the region and contribute to its sustainable development.

Table 5.1 Typology of Priority Areas of Cooperation

Theme	Areas of Cooperation	Description
Finance	**Private Sector Involvement**	Private sector can bring a range of resources, expertise, and innovative technologies to the agriculture sector, and can help to drive economic growth and job creation.
	Access to Finance	Many small and medium-sized farmers and SMEs in the agro-food industry struggle to access finance. Cooperation to improve access to finance can help to create financial products and services that meet the needs of farmers and SMEs in the agro-food industry.
Research & Extensions	**Agriculture Cooperatives and Extensions**	Cooperation between farmers, researchers, and extension agents can help to share knowledge and build capacity for improving agriculture and food production practices.
	Modern Technologies and Practices	Modern technologies and practices can help to overcome challenges such as water scarcity, land degradation, and climate change, while also increasing yields and improving the quality of crops. Some examples: drought-resistant crops, conservation agriculture, micro-irrigation, agroforestry, etc.
	Development of New Business Models	New business models can help to promote sustainable agriculture practices, create new market opportunities for small-scale farmers, and improve access to finance and other resources. For example: contract farming, farmer cooperatives, social enterprises, value-chain integration, and digital platforms.
Governance	**Land tenure & Property Rights**	Land tenure and property rights arrangements can have a significant impact on agricultural resource efficiency, as they influence access to land, investment decisions, and land use practices.
	Price Policies (including trade)	Price policies refer to government policies that affect the prices of agricultural inputs (e.g. fertilizers, seeds, and equipment) and outputs (e.g. crops and livestock). These policies can have a significant impact on the profitability of agriculture and the decisions made by farmers and agro industry.
	Improve Access to Market	Small-scale farmers and SMEs often face difficulties in accessing markets and getting fair prices for their products. Cooperation can help to improve market access and create value chains that benefit all stakeholders.
	Institutional Capacity	Effective governance of the food industry requires strong institutional capacity, including regulatory agencies, research institutions, and industry associations.
Rural Development & Resource Quality Improvements	**Rural Education & Training**	Cooperation in rural education & training can aid sharing of knowledge and building capacity for more productive agriculture and food production practices.
	Infrastructures	Inadequate infrastructures, such as roads, electricity, and storage facilities, can limit agricultural development in many countries. Cooperation aiming to develop and maintain the infrastructures is needed to support agricultural production and trade.
	Soil Fertility Management	Cooperation is needed to develop and implement sustainable soil management practices, such as conservation agriculture, crop rotation, and the use of organic fertilizers.
	Water Management	Improving water management practices, such as water harvesting and efficient irrigation methods, can help to optimize water use in agriculture.

Source: Authors compilation.

Finance

Improving access to finance can be a challenging task, especially for small farmers and SMEs in the agro-industry. Several financial instruments can be used and developed to improve access to finance, such as microfinance, leasing, agricultural value chain financing, credit guarantees, revolving funds, and agricultural funds.

On the other hand, private sector involvement can also play a crucial role in this domain. Private sector can bring a range of resources, expertise, and innovative technologies to the agriculture sector, and provide access to finance. Public-private partnerships can be used to leverage resources and expertise to support the development of the agro-industry. For example, a partnership between a financial institution and an agricultural cooperative can provide access to finance for small farmers and help to develop their capacity to produce high-quality products that meet market demand.

Furthermore, encouraging the establishment of processing facilities within OIC countries is essential to facilitate value addition. These facilities can include food processing plants, agro-industrial parks, and specialized factories that cater to specific product categories. Investing in modern and efficient processing infrastructure allows for the preservation of quality, extension of shelf life, and development of innovative products. This, in turn, opens up new market opportunities and expands the range of exportable agricultural products.

Research & Extensions

Research institutions and extension services work together to develop new technologies that can improve the efficiency and productivity of the agro-industry. Research institutions provide evidence-based research that can be used to inform policy development in the agro-industry. Examples of such measures include the introduction of more water-efficient crop varieties, better methods for managing soil, and more efficient irrigation systems. Extension services, on the other hand, are responsible for disseminating the technologies developed by research institutions to farmers and other stakeholders in the agro-industry. In order to ensure that new technologies are adopted and used properly, training and providing support are also critical elements.

Collaboration between countries can help to share knowledge, best practices, and technologies that can help to improve the efficiency, productivity, and sustainability of agriculture. This can be achieved through partnerships between agricultural research institutions, international organizations, and governments, leading to greater investment in research and development.

Furthermore, improvement of agriculture products through value addition can be very important for maximizing economic returns and minimizing post-harvest losses. Value addition involves transforming raw agricultural commodities into processed goods with enhanced market appeal and value. This can include activities such as cleaning, sorting, grading, packaging, and processing into intermediate or finished products. Improving research and extensions services that supports value addition can enable OIC countries to capture a larger share of the value chain, generate employment opportunities, and increase the income of farmers and workers involved in the sector.

Governance

Good governance can help to enhance the efficiency, productivity, and sustainability of the agro industry. This can lead to improved livelihoods for farmers, enhanced food security, and more sustainable use of natural resources. Governments can develop policies and regulations that incentivize sustainable practices and discourage

unsustainable ones. By addressing policies such as land tenure and property rights, price policies and trade, access to markets, and institutional capacity, governments can support the growth of the agro industry in a way that benefits both the economy and the environment.

Furthermore, cooperation between countries can lead to the development of trade agreements that can help to facilitate trade in agricultural products and reduce trade barriers, leading to increased market access and higher prices for farmers. Harmonization of policies and regulations can also help to reduce trade barriers and make it easier for agro-food producers to access finance and other resources.

Governments can also support the agro industry by improving access to markets. Creating access to markets might involve constructing physical infrastructure like roads and ports, as well as enacting policies and programmes that lower trade barriers and increase trade financing. Furthermore, expanding market access for agricultural products from OIC member countries can be done through various collaborative efforts such as trade promotion initiatives, market intelligence sharing, participation in trade fairs and exhibitions, and branding efforts.

Trade promotion initiatives play a vital role in creating awareness and generating interest in these products in target markets. OIC countries can collaborate to develop comprehensive trade promotion strategies that focus on highlighting the unique qualities of their agricultural goods. This can involve organizing trade missions, buyer-seller meetings, and business matchmaking events to facilitate direct interactions between producers and potential buyers.

Market intelligence sharing is another valuable approach to expand market access. OIC member countries can establish mechanisms for sharing information on market trends, consumer preferences, and emerging opportunities. Through this initiative, countries can make informed decisions regarding product development, packaging, and marketing strategies that align with target markets. Sharing market intelligence enables OIC countries to adapt their agricultural products to meet the evolving demands and preferences of consumers, thus increasing their competitiveness in global markets.

Participation in trade fairs and exhibitions provides a valuable platform for showcasing agricultural products from OIC member countries. Trade fairs offer an opportunity to engage with a wide range of buyers, importers, distributors, and industry professionals from around the world. OIC countries can collaborate to organize joint pavilions or country-specific showcases at prominent trade fairs to highlight their agricultural products. This collective presence can enhance visibility, create networking opportunities, and attract potential buyers who are interested in exploring products from OIC member countries.

Rural development & Resource Quality Improvements

The growth and development of the agro-food industry is also greatly influenced by both rural development and improvements in the quality of agricultural resources. Some of key areas of cooperation in this domain include rural education and training, infrastructures, soil fertility management, and water management.

Education for rural population can greatly improve the agricultural labour efficiency. Therefore, programs to provide workers with the skills and training needed to operate and maintain new technologies should be supported. This can include training on modern agricultural technologies, sustainable land management practices, and financial management. Infrastructure development is essential for improving the efficiency and productivity of the agro industry. Governments can invest in infrastructure development, including roads, electricity, and communication networks, to improve the access of farmers and agro-industry enterprises to markets, information, and other resources.

In term of natural resources quality improvements, management of soil fertility and water are very important to ensure land productivity. Policies and programs that promote sustainable soil and water management practices, such as integrated soil fertility management, conservation agriculture, drip irrigation, and rainwater harvesting, should be pursued.

Furthermore, countries can collaborate to address common challenges related to disasters, such as floods, droughts, and pest outbreaks. Cooperation can lead to the development of risk reduction and management strategies that can help to mitigate the impact of disasters on agriculture and ensure the continued productivity of the sector.

Roles of OIC Institutions

OIC institutions play a critical role in promoting cooperation in agricultural development and food security among the member countries. The OIC has established several institutions that are involved in various aspects of agricultural development and food security. These institutions work to provide funding for agricultural projects and programs, conduct research on food security issues, develop standards for food and agriculture, and promote economic cooperation and trade in the sector.

The Islamic Development Bank (IsDB), for instance, can provide financing for agricultural projects and facilitate trade and investment in the sector. The Islamic Organisation for Food Security (IOFS) can enhance cooperation and collaboration among member countries and develop comprehensive agricultural strategies and policies. The Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC) can assist member states in relevant statistics, socioeconomic research, and capacity building. The OIC can also work towards creating a unified system for quality standards and certification of halal food, which would boost intra-OIC trade in food products. This, in turn, can enhance food security and economic development in member countries. Some of the main relevant OIC institutions are listed as follow:

Islamic Organisation for Food Security (IOFS): IOFS is a specialized institution of the OIC that was established in 2019 to promote food security and agricultural development among member countries. The organization aims to enhance cooperation and collaboration among member countries in the areas of food production, trade, research, and capacity building.

BOX D SESRIC's Capacity Building Initiatives to Improve Agricultural Productivity

SESRIC has been actively working towards enhancing agricultural productivity in the OIC member countries. This is being done through its various capacity-building programs and projects, such as Agriculture and Food Security Capacity Building Programme, Statistical Capacity Building Programme, Cotton Capacity Building Programme, Water Resources Management Capacity Building Programme, and Reverse Linkage Project between Bangladesh and Türkiye on Cotton Varieties Development. Through these programmes and projects, SESRIC provides training opportunities by facilitating the transfer and exchange of know-how, knowledge and experience among the relevant national institutions in the OIC member countries.

- **Agriculture and Food Security Capacity Building Programme** focuses on improving the capacity of Member Countries to develop and implement policies that support sustainable agriculture and food security. This includes capacity-building activities in crop production, livestock management, agricultural marketing, etc.
- **Statistical Capacity Building (StatCaB) Programme** is a flagship capacity development initiative aimed at strengthening and improving the National Statistical Systems (NSSs) in the OIC member countries with a view to producing better national statistics and thus helping policy-makers introducing better national policies and strategies. The programme strives to identify the statistical needs and capacities of NSSs and promotes the exchange of experts among OIC member countries through a range of activities, including statistical training courses, study visits, technical missions, and webinars. The StatCaB Programme addresses a diverse range of statistical activities which include agriculture, forestry, and fishing statistics, such as agricultural monetary statistics (agricultural economic accounts), agricultural structures (farm structure), trade in agricultural products, crop and animal production, and many others.
- **Cotton Capacity Building Programme** aims to improve the competitiveness of cotton production in OIC Member Countries. This includes capacity-building activities in cotton cultivation, harvesting, processing, etc.
- **Water Resources Management Capacity Building Programme** focuses on improving water resource management in the member countries by providing capacity-building activities on water conservation, irrigation, water quality management, etc.
- **Reverse Linkage Project between Bangladesh and Türkiye on Cotton Varieties Development** aims to enhance the local cotton production in Bangladesh, particularly in less productive agricultural land.

Some of the implemented activities within the framework of mentioned programmes and projects are:

Activities	Date	Beneficiary OIC Countries
Training Course on "New Approaches in Cotton Agronomy: Sowing Experiments"	10-16 June 2023	Bangladesh
Training Course on "Productivity Enhancement of Cotton by Using Modern Agronomic Practices"	14-16 February 2023	Benin, Burkina Faso, Chad, Cote d'Ivoire, The Gambia, Guinea, Mozambique, Niger, Nigeria, Senegal, Togo and Uganda
Training Workshop on "Water Governance and Integrated Water Resources Management in OIC Member Countries"	24-26 January 2023	Azerbaijan, Bahrain, Burkina Faso, Chad, Egypt, Guinea-Bissau, Indonesia, Iraq, Jordan, Libya, Maldives, Morocco, Niger, Nigeria, Pakistan, Palestine, Qatar, Senegal, Sierra Leone, Sudan, Tajikistan, Tunisia, Türkiye, United Arab Emirates, Uzbekistan and Yemen
Training Course on "Enhancing Food Security through Efficient Irrigation Systems"	23-25 August 2022	Afghanistan, Azerbaijan, Cameroon, Cote d'Ivoire, Egypt, The Gambia, Iraq, Jordan, Malaysia, Mali, Morocco, Niger, Nigeria, Qatar, Sierra Leone, Sudan, Suriname, Tajikistan, Togo, Tunisia, Türkiye, and the United Arab Emirates

Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC): SESRIC is a subsidiary organs of OIC in charge of promoting socio-economic development in the context of advancing intra-OIC cooperation in the relevant areas of its mandate, namely statistics, economic and social research and training and technical cooperation. The centre's work on food security and agriculture includes disseminating statistical data, conducting research, and providing training and technical assistance to member countries. Some of SESRIC's initiatives to improve agricultural productivity in OIC can be seen in **BOX D**.

Islamic Development Bank (IsDB): The IsDB is a multilateral development bank that provides financing for projects and programs aimed at improving economic and social development in OIC member countries. The bank provides funding for agriculture and rural development projects, as well as food security programs, through its Agriculture and Rural Development Department.

Islamic Centre for Development of Trade (ICDT): ICDT aims is to promote economic development and trade among OIC member countries. The ICDT seeks to achieve its objectives through various means, such as organizing trade fairs and exhibitions, providing technical assistance and training, conducting research and studies, and facilitating trade missions and business partnerships. Some of the role of ICDT in agricultural development and food security is through trade fairs and exhibitions, including the annual Halal Expos and specialized agricultural exhibitions. ICDT is also encouraging and developing regular trade exchanges in agricultural commodities and promoting intra-OIC investments.

Standards and Metrology Institute for the Islamic Countries (SMIIC): SMIIC is a standard-setting organization that develops and promotes standards for various sectors, including food and agriculture. The organization works to promote harmonization of standards among OIC member countries, which can facilitate trade and improve food safety and quality. OIC/SMIIC Halal standards were developed for production, certification and accreditation along with the new SMIIC vision to create a quality infrastructure that improves economy and welfare of the OIC Member States.

Standing Committee for Economic and Commercial Cooperation of the OIC (COMCEC): COMCEC is a committee that promotes economic and commercial cooperation among OIC member countries. The committee's work includes promoting agricultural trade and investment, as well as developing strategies to improve agricultural development and food security in member countries.

Standing Committee for Scientific and Technological Cooperation of the OIC (COMSTECH): COMSTECH is a science and technology organization that aims to promote scientific and technological cooperation among member countries. While it is not solely focused on agriculture and food security, the organization has conducted research and provided training in these areas, and has supported initiatives to improve agricultural development and food security in member countries. For instance, there were some initiatives related to introducing new breeding technologies, preservation of plant genetic resources and developing gene banks, and capacity building in modern agricultural technologies.

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ANNEXES

ANNEX A. Country Classifications

OIC Member Countries (57):

AFG	Afghanistan	GAB	Gabon	MDV	Maldives	SDN	Sudan
ALB	Albania	GMB	Gambia	MLI	Mali	SUR	Suriname
DZA	Algeria	GIN	Guinea	MRT	Mauritania	SYR	Syria*
AZE	Azerbaijan	GNB	Guinea-Bissau	MAR	Morocco	TJK	Tajikistan
BHR	Bahrain	GUY	Guyana	MOZ	Mozambique	TGO	Togo
BGD	Bangladesh	IDN	Indonesia	NER	Niger	TUN	Tunisia
BEN	Benin	IRN	Iran	NGA	Nigeria	TUR	Türkiye
BRN	Brunei Darussalam	IRQ	Iraq	OMN	Oman	TKM	Turkmenistan
BFA	Burkina Faso	JOR	Jordan	PAK	Pakistan	UGA	Uganda
CMR	Cameroon	KAZ	Kazakhstan	PSE	Palestine	ARE	United Arab Emirates
TCD	Chad	KWT	Kuwait	QAT	Qatar	UZB	Uzbekistan
COM	Comoros	KGZ	Kyrgyzstan	SAU	Saudi Arabia	YEM	Yemen
CIV	Cote d'Ivoire	LBN	Lebanon	SEN	Senegal		
DJI	Djibouti	LBY	Libya	SLE	Sierra Leone		
EGY	Egypt	MYS	Malaysia	SOM	Somalia		

* Syria is currently suspended from OIC membership.

Note: Country codes are based on ISO 3166-1 alpha-3 codes.

Non-OIC Developing Countries (98):

Angola	Dominica	Madagascar	São Tomé and Príncipe
Antigua and Barbuda	Dominican Republic	Malawi	Serbia
Argentina	Ecuador	Marshall Islands	Seychelles
Armenia	El Salvador	Mauritius	Solomon Islands
The Bahamas	Equatorial Guinea	Mexico	South Africa
Barbados	Eritrea	Micronesia	South Sudan
Belarus	Ethiopia	Moldova	Sri Lanka
Belize	Fiji	Mongolia	St. Kitts and Nevis
Bhutan	Georgia	Montenegro	St. Lucia
Bolivia	Ghana	Myanmar	St. Vincent and the Grenadines
Bosnia and Herzegovina	Grenada	Namibia	Swaziland
Botswana	Guatemala	Nauru	Tanzania
Brazil	Haiti	Nepal	Thailand
Bulgaria	Honduras	Nicaragua	Timor-Leste
Burundi	Hungary	Palau	Tonga
Cabo Verde	India	Papua New Guinea	Trinidad and Tobago
Cambodia	Jamaica	Paraguay	Tuvalu
Central African Republic	Kenya	Peru	Ukraine
Chile	Kiribati	Philippines	Uruguay
China	Kosovo	Poland	Vanuatu
Colombia	Lao P.D.R.	Romania	Venezuela

Democratic Republic of the Congo	Lesotho	Russia	Vietnam
Republic of Congo	Liberia	Rwanda	Zambia
Costa Rica	North Macedonia	Samoa	Zimbabwe
Croatia	Panama		

Developed Countries (39):**

Australia	Germany	Lithuania	Singapore
Austria	Greece	Luxembourg	Slovak Republic
Belgium	Hong Kong	Macao SAR	Slovenia
Canada	Iceland	Malta	Spain
Cyprus	Ireland	Netherlands	Sweden
Czech Republic	Israel	New Zealand	Switzerland
Denmark	Italy	Norway	Taiwan
Estonia	Japan	Portugal	United Kingdom
Finland	Korea, Rep.	Puerto Rico	United States
France	Latvia	San Marino	

** Based on the list of advanced countries classified by the IMF.

Income Classification of OIC Member Countries

Low Income (16)

Afghanistan	Mozambique	Uganda
Burkina Faso	Niger	Yemen
Chad	Sierra Leone	
Gambia	Somalia	
Guinea	Sudan	
Guinea-Bissau	Syria *	
Mali	Togo	

*Syria is currently suspended from its OIC membership.

Lower-middle Income (20)

Algeria	Egypt	Pakistan
Bangladesh	Indonesia	Palestine
Benin	Iran	Senegal
Cameroon	Kyrgyzstan	Tajikistan
Comoros	Mauritania	Tunisia
Côte d'Ivoire	Morocco	Uzbekistan
Djibouti	Nigeria	

Upper-middle Income (14)

Albania	Jordan	Maldives
Azerbaijan	Kazakhstan	Suriname
Gabon	Lebanon	Türkiye
Guyana	Libya	Turkmenistan
Iraq	Malaysia	

High Income (7)

Bahrain	Oman	United Arab Emirates
Brunei Darussalam	Qatar	
Kuwait	Saudi Arabia	

Note: Based on World Bank income classification 2020.

ANNEX B. Sources of Agricultural Production output Growth by Country

Average Annual Growth of Agricultural Production output and Its Sources, 2011-2020

Income	Country	Labor	Capital	Materials	Land Expansion	Input	TFP	Output
MI-L	Senegal	-2.2%	0.3%	0.0%	5.8%	4.0%	6.5%	10.5%
HI	Saudi Arabia	-0.7%	0.1%	-0.4%	1.1%	0.2%	5.5%	5.7%
HI	United Arab Emirates	-1.0%	0.1%	-0.5%	0.9%	-0.5%	5.4%	4.9%
MI-L	Tajikistan	-0.3%	0.1%	0.9%	1.4%	2.2%	5.1%	7.2%
LI	Niger	0.2%	-0.7%	0.1%	1.7%	1.2%	4.6%	5.8%
MI-U	Kazakhstan	-1.9%	-0.8%	1.1%	0.0%	-1.6%	4.6%	2.9%
HI	Bahrain	0.3%	0.3%	6.2%	-0.1%	6.6%	4.5%	11.2%
LI	Afghanistan	0.3%	-0.9%	-0.7%	0.2%	-1.2%	3.4%	2.3%
MI-L	Tunisia	-0.1%	0.1%	0.6%	0.0%	0.6%	2.7%	3.3%
MI-L	Indonesia	-1.0%	0.3%	0.2%	1.6%	1.1%	2.5%	3.6%
MI-U	Guyana	-0.5%	1.8%	0.3%	0.4%	2.1%	2.4%	4.5%
MI-L	Pakistan	0.1%	0.3%	0.5%	0.2%	1.1%	1.7%	2.8%
MI-L	Lebanon	0.3%	0.2%	0.6%	-0.3%	0.8%	1.7%	2.5%
MI-U	Türkiye	-0.2%	0.2%	1.3%	-0.3%	1.0%	1.6%	2.6%
HI	Qatar	-0.1%	0.2%	2.0%	3.3%	5.3%	1.4%	6.7%
MI-U	Libya	0.0%	-0.1%	-1.6%	0.0%	-1.7%	1.3%	-0.4%
MI-U	Azerbaijan	0.0%	0.1%	1.6%	0.8%	2.5%	1.3%	3.8%
MI-L	Kyrgyzstan	-0.1%	1.1%	0.6%	0.0%	1.6%	1.1%	2.7%
MI-L	Algeria	0.0%	0.3%	1.0%	0.8%	2.0%	0.9%	3.0%
MI-L	Mauritania	0.1%	1.0%	0.1%	0.5%	1.7%	0.8%	2.5%
MI-L	Uzbekistan	-0.1%	1.8%	0.5%	0.0%	2.2%	0.7%	2.9%
MI-L	Egypt	-0.4%	0.2%	-0.1%	0.8%	0.5%	0.6%	1.1%
LI	Syria*	-0.2%	0.0%	-2.2%	-0.2%	-2.6%	0.5%	-2.1%
HI	Oman	-0.3%	-0.7%	2.0%	5.7%	6.6%	0.2%	6.8%
MI-L	Nigeria	-1.0%	0.2%	0.1%	3.6%	2.9%	0.1%	3.1%
HI	Brunei Darussalam	0.7%	0.5%	1.2%	0.0%	2.4%	0.0%	2.4%
MI-U	Jordan	0.2%	0.2%	1.0%	0.2%	1.7%	-0.1%	1.6%
MI-L	Morocco	-0.4%	0.2%	0.3%	1.6%	1.7%	-0.2%	1.5%
LI	Chad	0.2%	2.5%	0.4%	1.3%	4.4%	-0.3%	4.1%
LI	Sudan	-1.1%	-0.6%	0.3%	5.8%	4.4%	-0.3%	4.1%
MI-U	Malaysia	-1.0%	0.4%	0.0%	1.4%	0.7%	-0.3%	0.4%
MI-L	Cameroon	-0.3%	1.1%	0.1%	1.7%	2.6%	-0.3%	2.3%
MI-L	Côte d'Ivoire	-1.0%	0.2%	0.1%	6.2%	5.5%	-0.4%	5.1%
HI	Kuwait	0.1%	0.5%	3.1%	0.2%	3.9%	-0.4%	3.5%
LI	Guinea	-0.6%	1.4%	0.5%	4.0%	5.3%	-0.4%	4.8%
LI	Mozambique	0.4%	1.9%	-0.1%	0.5%	2.7%	-0.5%	2.2%
MI-U	Albania	-0.4%	0.5%	2.1%	0.1%	2.3%	-0.6%	1.8%
MI-U	Suriname	0.2%	0.7%	-0.5%	1.3%	1.6%	-0.8%	0.9%
LI	Togo	-0.5%	0.8%	0.0%	2.3%	2.6%	-0.8%	1.9%
MI-L	Comoros	0.0%	0.8%	0.4%	0.1%	1.3%	-0.8%	0.5%
MI-L	Bangladesh	-0.8%	1.2%	0.3%	2.7%	3.5%	-0.9%	2.5%
MI-U	Gabon	0.0%	0.6%	0.6%	1.1%	2.3%	-1.0%	1.3%
LI	Uganda	0.2%	1.3%	-0.4%	2.2%	3.3%	-1.0%	2.3%
LI	Somalia	-0.3%	-0.2%	-0.1%	0.4%	-0.2%	-1.0%	-1.2%
MI-L	Iran	0.1%	0.1%	1.1%	0.4%	1.8%	-1.0%	0.7%
LI	Yemen	0.5%	0.0%	0.0%	-0.1%	0.4%	-1.0%	-0.7%
MI-L	Benin	-1.5%	2.0%	0.7%	4.2%	5.5%	-1.3%	4.2%
LI	Mali	-0.3%	2.8%	1.2%	2.7%	6.4%	-1.3%	5.1%
LI	Gambia	0.6%	0.7%	-0.1%	-0.4%	0.9%	-1.6%	-0.7%
MI-L	Djibouti	-0.7%	2.6%	0.1%	0.1%	2.1%	-1.6%	0.5%
LI	Guinea-Bissau	-0.1%	1.6%	0.5%	1.5%	3.5%	-2.1%	1.4%
LI	Burkina Faso	-0.1%	1.8%	-0.2%	2.5%	4.0%	-2.2%	1.8%
MI-U	Turkmenistan	-0.5%	2.5%	-0.1%	0.0%	2.0%	-2.5%	-0.5%
MI-L	Palestine	-1.4%	-0.1%	-1.3%	5.4%	2.7%	-3.0%	-0.4%
MI-U	Iraq	0.1%	0.1%	0.6%	0.7%	1.4%	-3.8%	-2.3%
LI	Sierra Leone	-0.3%	2.7%	0.8%	-1.5%	1.7%	-4.4%	-2.6%

*Syria is currently suspended from its OIC membership.

Note: Sorted by largest TFP growth. LI = Low Income, MI-L = Lower-middle Income, MI-U = Upper-middle Income, HI = High Income. Growth of input is the sum of growth of labour, capital, materials, and land expansion. Growth of output is the sum of growth of input and TFP.

ANNEX C. HS Product Description

HS Product Description for 2-digit HS Codes from 1 to 24

HS Code	Product Description
01	Live animals
02	Meat and edible meat offal
03	Fish and crustaceans, molluscs and other aquatic invertebrates
04	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
05	Products of animal origin, not elsewhere specified or included
06	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
07	Edible vegetables and certain roots and tubers
08	Edible fruit and nuts; peel of citrus fruit or melons
09	Coffee, tea, maté and spices
10	Cereals
11	Products of the milling industry; malt; starches; inulin; wheat gluten
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder
13	Lac; gums, resins and other vegetable saps and extracts
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes
16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch or milk; pastrycooks' products
20	Preparations of vegetables, fruit, nuts or other parts of plants
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar
23	Residues and waste from the food industries; prepared animal fodder
24	Tobacco and manufactured tobacco substitutes

ANNEX D. Methodology of IOFS's Food Security Index (FSI)

Approach

The FAO food balance sheet data was used to create the food security index. The data includes a lot of food item types, and each food item has different importance for food security. Therefore, we weighed each food item by special weights based on the World Food Program (WFP) weights. The WFP weights are used to weigh survey data, but collecting survey data is difficult. Hence, we used the WFP weights to guide our weights for the food security index.

We converted simple indexes 1 to 3 to reflect the situation of the countries regarding the Food Security Index (FSI). The FSI values were calculated by aggregating each country's weighted food item values. This new index can help policymakers and stakeholders understand the food security situation in OIC countries. It is a new index that can be updated with weights and methodologies to fine-tune its accuracy.

Methodology Details

In this study, we analyzed the FAO Food Balance Sheet Data to investigate food security in various countries. The data was organized in a table, A, where the first column represents the countries, the second column represents the food item types, and the remaining columns represent the yearly values.

We followed a four-step process to analyze the data:

Weighting the Food Items: We used the WFP weights for their food security index to weigh the food items in the table. The result of weights table is referred to as table W, where W_j represents the weight of food item j. Those weights reflect the importance of the food items.

Calculating the Weighted Sum of Food Items: We then multiplied table A and table W, which resulted in a weighted sum of all food items for all countries. This table is referred to as table J, where $J_{i,j} = \sum_{k=1}^{n} W_k \, A_{i,k}$, and n is the total number of food items.

Grouping the Values by Country: To understand the food security situations in each country, we grouped the values in table J by food items and calculated the sum of these values for each country. This resulted in table F, which displays the total weighted sum of food items for each country, where $F_{i,j} = \sum_{k=1}^{m} J_{k,j}$, and m is the total number of countries.

Categorizing the Data into Bins: The values in Table F varied greatly, and we categorized them statistically into three bins: 1 represents the worst situation, 2 represents a medium situation, and 3 represents the best situation.

We can summarize these steps mathematically as follows:

Let A be the original table of FAO Food Balance Sheet Data, where $A_{i,j}$ represents the value for country i and food item j.

- Let W be the WFP weights for their food security index, where W_j represents the weight for food item j.
- We calculate the weighted sum of all food items for all countries by multiplying A and W. This results in table J, where $J_{i,j} = \sum_{k=1}^{n} W_k A_{i,k}$, where n is the total number of food items.
- We group the values in table J by food items and calculate the sum of these values for each country. This results in table F, where $F_{i,j} = \sum_{k=1}^{m} J_{k,j}$, where m is the total number of countries.
- Finally, we categorize the values in Table $into$ three bins using statistical methods, with 1 representing the worst situation, 2 representing a medium situation, and 3 representing the best situation.

In conclusion, this four-step process provides a comprehensive analysis of food security situations in various countries, allowing for a better understanding of the factors that affect food security at an OIC scale.