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THE MOST BINDING CONSTRAINTS OF GROWTH IN IRAQI AGRICULTURE

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Report on the Publications Included in this Doctoral Thesis

This Doctoral Thesis comprises a compilation of previously published works consisting of four articles published in scientific journals indexed in the Scientific Journal Rankings database.

1- Al-Tulaibawi, A., de Frutos Madrazo, P. & Martín-Cervantes, P. A. (2024). Rehabilitation of the agricultural sector in conflict-affected areas: The case of the Yazidi areas in Iraq after the ISIS crisis. *Evolutionary Studies in Imaginative Culture*, 8.1(S3), 155–168. https://doi.org/10.70082/esiculture.vi.2621.
Retrieved from esiculture.com.
Categories: Cultural Studies
Quartile: Q2.

2- Al-Tulaibawi, A., de Frutos Madrazo, P. & Martín-Cervantes, P. A. (2024). Analysis of the impact of agriculture goods dumping in Iraq using ARDL methodology. *Edelweiss Applied Science and Technology*, 8(6), 4841–4862.
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3- Al-Tulaibawi, A., de Frutos Madrazo, P. & Martín-Cervantes, P. A. (2024). Advantages of implementing contract farming in Iraq. *Journal of Ecohumanism*, 3(8), 617–629. https://doi.org/10.62754/joe.v3i8.4756.
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Two articles were published in scientific journals; one journal is indexed in the Web of Science database, and the other journal is indexed in the Scopus database.

5- Al-Tulaibawi, A., de Frutos Madrazo, P. & Martín-Cervantes, P. A. (2024). Waqf: An advanced approach to combating agricultural land fragmentation in Islamic countries. *World*, 5(4), 1386–1403. https://doi.org/10.3390/world5040070.
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6- Al-Tulaibawi, A., de Frutos Madrazo, P. & Martín-Cervantes, P. A. (2024). Land ownership system in Iraq and the utilization of the Albanian experience. *Library Progress (International)*, 44(3), 19076–19095.
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Abstract

Agriculture plays a crucial role in the economy of Iraq, contributing significantly to food security and providing employment for a substantial portion of the population. Nevertheless, the sector encounters several formidable challenges that impede its growth, including issues related to land ownership laws, land fragmentation, inadequate infrastructure, prolonged insecurity, and the agricultural dumping of goods from neighboring countries. These factors substantially affect agricultural productivity and economic development, necessitating a thorough analysis to identify the most pressing obstacles and propose sustainable solutions.

This dissertation aims to address the challenges associated with infrastructure, the dumping of agricultural products, and the implications of land ownership systems. It proposes innovative strategies, including contract farming, while drawing on lessons from international best practices to revitalize the agricultural industry. Furthermore, the study examines the application of advanced technologies within Iraq's agricultural sector to enhance resource utilization and promote self-sufficiency along with sustainable development.

The research employs the Growth Diagnostics approach, a systematic framework designed to identify the most binding constraints on economic growth. This methodology involves the analysis of significant agricultural challenges in Iraq through both qualitative information and quantitative data, prioritizing issues such as land fragmentation, protective legislation, and market dynamics to propose targeted and sustainable solutions.

The significance of this study lies in its potential to improve agricultural performance in Iraq, thereby ensuring food security and fostering economic development. It provides a comprehensive framework aimed at enhancing agricultural policies and supporting farmers in overcoming critical challenges.

The research indicates that the deterioration of infrastructure resulting from ongoing conflicts undermines productivity. It suggests that a gradual investment in

infrastructure repair could facilitate the recovery of the agricultural sector. Additionally, the inundation of the agricultural market with foreign goods exacerbates the issues faced by local producers, indicating that the implementation of protectionist laws is necessary to shield them from such competition. Finally, the concepts of contract farming and the adoption of modern technology present promising solutions for improving agricultural marketing and supporting farmers effectively.

Keywords: Iraqi Agriculture Economics; Growth Diagnostics; Agriculture Land Fragmentation; Islamic Inheritance Law; Waqf (Endowment); Land Ownership; Goods Dumping; Protectionist Economic Policies; Food Security; Contract Farming; Smart Farm Management; Social Factors and Economic Development.

JEL Classification Codes: A, General Economics and Teaching: A1, General Economics, A11, Role of Economics • Role of Economists • Market for Economists; F, International Economics: F1, Trade, F13, Trade Policy • International Trade Organizations; H, Public Economics: H00, General, H3, Fiscal Policies and Behavior of Economic Agents, H31, Household, H2, Taxation, Subsidies, and Revenue, H25, Business Taxes and Subsidies; K, Law and Economics: K2, Regulation and Business Law, K23, Regulated Industries and Administrative Law; O, Economic Development: Innovation, Technological Change, and Growth, O1, Economic Development, O13, Agriculture • Natural Resources • Energy • Environment • Other Primary Products; Q, Agricultural and Natural Resource Economics • Environmental and Ecological Economics: Q 01, Sustainable Development, Q1, Agriculture, Q15, Land Ownership and Tenure • Land Reform • Land Use • Irrigation • Agriculture and Environment, Q18, Agricultural Policy • Food Policy • Animal Welfare Policy, Q2, Renewable Resources and Conservation, Q24, Land, Q28, Government Policy.

1. Introduction

Agriculture in Iraq has faced multiple challenges since 1980, including wars and political instability. This has resulted in a fragile agricultural sector that struggles to meet the increasing demand for agricultural products due to high population growth. The country is facing a wide variety of constraints that seem to impede the ability of the agricultural sector to raise its aggregate supply potential over time. These constraints vary significantly in terms of nature, but a limited set of these constraints is more binding than others (Ruzzante et al., 2021). Overcoming these most binding constraints of growth is required for sustainable growth of agricultural productivity. The country predominantly suffers from poor and economic infrastructure, as well as underemployment and unemployment in the rural areas. Despite the importance of the agricultural sector, it is subject to many policy inadequacies and deficiencies related to the poor marketing system and credit accessibility, and high dependency on situational treatment legislation and immigration of labor from rural areas.

The objective of this dissertation is to identify the most binding constraints of growth and to analyze the respective issues in detail, specifying their symptoms and causes and providing a clear analysis of the possible direct and indirect effects of each constraint. This process demonstrates the significance of the constraints, and precise in-depth details are discussed for quick intervention. This is significant so that the provision of services to those areas could be planned for, and development opportunities could be developed to diversify from agriculture to overcome each constrained area separately. Hence, this dissertation constitutes a first attempt to systematically and explicitly identify the most binding constraints on the growth of agricultural productivity in Iraq.

1.1. Background

The ancient civilization of Mesopotamia, which is located in present-day Iraq, largely depended on agriculture. The need for systematic agriculture led to the development of organized fields and a complex irrigation system in the ancient Mesopotamian world. Ancient Mesopotamia is known as the 'Cradle of Civilization'

due to the two rivers Tigris and Euphrates, which were responsible for the birth and sustenance of the world's first great civilization in what is now Iraq (Baker, 1955).

The modern concept of agriculture means the ongoing process of development of agricultural practices, including production, management, improvement, natural resource management, technology, manures, seeds, pesticides, implements, social structure, and many sub-disciplines. Iraq is one of the countries in the Middle East and has, for a time in its history, been a world leader in agricultural development (White, 1959). In the 18th through the first half of the 19th centuries, Iraqi agricultural production was on self-sufficient levels in producing food and livestock, mainly wheat, rice, fruits, vegetables, sheep and poultry products. These and some other agricultural goods displayed a high level of productivity and were also exported. In the twentieth century, agricultural production fluctuates according to the economic policies that came from the political and legal conditions that the country went through (Jalal, 2015).

Agricultural policy is crucial for sustainable social and economic development in the Iraqi economy. Despite this significance, several obstacles limit agricultural development and decrease productivity in the sector. Moreover, the current conditions provide no space for the development or diversification of income sources. Since the 1980s, agricultural productivity in Iraq has decreased due to wars, which caused the lack of investment in the agricultural sector, poor technology, and the conversion of arable land to other uses (Marr, 1985). The Iraqi agricultural sector also faces several constraints, which have negatively affected farming performance, namely governance issues, government policies, and subsidies rather than private investment, security instability, poor use of irrigation water, land fragmentation, and lack of technical, and marketing services as well as production inputs. In addition, water scarcity has negatively affected productivity, and disputes between Iraqi authorities and some neighborhood countries reduce the available water for agricultural land. The low level of agricultural investment has directly impacted agricultural productivity, resulting in low productivity levels.

The wars have led to a sharp decline in productivity due to significant damage to infrastructure, seed banks, and irrigation systems, along with the displacement

of families and farmers from conflict-affected areas. The destruction of numerous farms, with machinery and other fixed assets being devastated, livestock stolen. Contamination of the land by landmines and the constant threat of violent confrontations have restricted the access and movement of farmers, workers and herders, creating areas of misery within rural villages. In many instances, individuals have been forcibly displaced, with some either missing or having lost their lives (Unruh, 2020). Additionally, government priorities have often skewed towards military funding rather than developmental initiatives. Despite ongoing efforts to rehabilitate this vital sector and implement infrastructure improvements, the most formidable challenge remains ensuring the sustainability of these initiatives.

Although a slight decrease in production was observed in 2015, the situation saw a considerable deterioration in 2016. The immediate focus on the crisis failed to address the intricate interplay among misgovernance, violence, declining soil fertility, reliance on wheat and barley varieties susceptible to disease, inadequate access to certified seeds, and the limited dissemination of modern agricultural technologies. Collectively, these factors have severely constrained the potential for widespread agricultural development in Iraq (Al-Khoei et al., 2017). By 2016, the displacement of families had rendered 12% of the Iraqi workforce unemployed. The rural populace experienced substantial losses in fixed assets and sought refuge elsewhere. The immediate effects of the invasion led to the region relying primarily on food sourced through trade routes and humanitarian assistance, including food aid. Notably, food security concerns have intensified in areas hosting internally displaced persons, where the absence of agricultural advancement has not been matched by employment opportunities in the industrial sector (Rostam & Reinhard, 2023).

From 2017 to the present, the reliance has increasingly shifted toward traders' goods supply chains in rural areas. A focus group study conducted in 2017 in north Iraq revealed that 45% of participants abandoned the prospect of returning to their original communities due to persistent threats from rival groups attempting to seize land or the re-emergence of hardline members supported by recognized tribal leaders. The prevailing insecurity poses a significant obstacle to the success of

community-based socioeconomic recovery initiatives. Farmers express fear regarding agricultural investment, including planting, permanent cropping options, infrastructural improvements to their homes, and the development of water retention and road resilience projects, largely due to the continuous military presence in the region. Despite market opportunities presented by certain agricultural products, such as fruit from tree plantations that yield well and are marketed, the profits from these sales often reportedly benefit terrorist groups, and the farmers are forced to pay, especially between the years 2014-2018 (Ahmed & Heun, 2023).

Threats to food supply security hold significant importance, as this aspect of security is frequently interconnected with energy supply considerations. Discussions surrounding security within this sector primarily take place in the context of international relations. However, food security is considered central to human physical welfare and, thus, economic and individual security. It is not only tied to social and political stability but also to national security (Ali, 2020). Within this area, concern is high that extended civil conflict or large-scale acts of terrorism could have a disastrous effect on the investment and then food supplies. There was direct terrorist action against the agricultural infrastructure or terrorist attacks against water supplies used in irrigation. Iraq is facing today such threats from terrorists that have emerged and caused the fall of many towns in the north and west of Iraq. Equally important is the lack of basic legal frameworks protecting the property rights of Iraqi farmers and the application of dumping measures on certain products imported from other countries (Kim & Roh, 2022). This means that since that time, a lot of economic and technical resources have been and are still being spent on the construction of large infrastructures that have proven to have a fragmented influence and effects, with some of them proving to be negative when considered from the viewpoint of the tapped natural or external environment, including the buildup of so much silt in the man-made lakes that results in the reduction of their useful storage capacity and, of course, their lifespan (Blonigen & Prusa, 2016).

Iraq started importing food to meet local demand around 20 years ago, and this trend has accelerated in recent years. Net food imports have been estimated to be

around two-thirds of domestic consumption. With regard to cereals as the primary food group in the country, the import dependence ratio, an indicator of the amount of local food production of cereals that were imported and also the amount of sector production, amounted to 58.1% on average during the years 2015-2019 (FAO, 2020). There were, however, also climatic and other environmental reasons behind Iraq's setback in agricultural production.

There is limited adoption of modern agricultural technologies across the Iraqi sectors. Various indicators suggest that modern agricultural technologies have not been significantly disseminated in Iraq. They are not adopted or imitated, and there are significant factors contributing to this issue. Beyond this, the slow adoption or the less diffusion of such technologies can hinder the overall improvement and level of agricultural productivity (Javaid et al., 2022). Farming communities often find it difficult to access capital in order to buy such technology; they often continue to rely on traditional farming practices and remain dependent on continued manual labor. Field-level surveys have revealed that the adoption of modern agricultural technology in developing countries has been slow due to the heavy reliance on manual labor in intensive agriculture, the small scale in which agriculture is practiced, and the limited access to financing (Dhanaraju et al., 2022).

The factors that affect the insufficient adoption of modern agricultural technology in Iraq are different from, but in some cases quite similar to, those in other developing countries, who do not have the ability to keep up with technological innovations. Results based on longitudinal data obtained from individual farmer households reveal that the adoption of labor-saving and double-cropping technologies by Iraqi farmers is slow. Most farmers resist investments in household technology and equipment because they fear risk. Furthermore, smallholder farmers have limited knowledge about the emergence of modern farming technologies. To overcome this, the provision of benefits to farmers and careful planning, as well as government intervention, is required, as demonstrated in other regions. Therefore, the adoption and diffusion of new agricultural technologies in Iraq, especially at the household level, have been slow (Mahbub, 2020). This needs to be addressed, and strategic resources should be set aside for the agricultural sector (Adam-Bradford et al., 2020).

The obstacles to the adoption of modern technologies are varied and numerous, differing significantly across various research areas and districts. Knowing the skills of these techniques is not easy, also the financial aspect is a very crucial variable, as most farmers have very little per capita available. The little money they have is needed to run all sorts of other household expenses. This means that very little money, if at all, is left available for investing in agricultural machines and tools (Salih & Layeeq, 2023). The lack of technical training on the part of the agricultural staff seems to prevent them from effectively exploiting the modern technologies available. Other barriers might be due to the socio-cultural constraints, such as the traditional attitudes and farming practices that characterize most of the farming communities. These barriers to the different farming systems should be carefully assessed within the context of different areas to come up with resulting solutions specific to the area (Sinha & Dhanalakshmi, 2022). In some areas, people are used to the long, time-consuming labor needed to manage a few hens or cattle. They would spend half the day looking for free space and scarce available resources such as straw and feed for the livestock. Modern and mechanical approaches to increase livestock and poultry production would not be feasible in this case. Bureaucracy also severely hampers the delivery of the much-needed technical service system. There is a huge gap between the end user and the technical service, and it seems the two will never meet (Boursianis et al., 2022).

Agricultural development in Iraq is a history of everchanging planning and management experiments of successive political regimes with mostly contradicting ideologies. “In the past it seemed obvious to foreign observers and Iraqi administrators that if only Iraq could get rid of its large landowners it would be able to progress towards sustainable development” (Simmons, 1965). Later, the failures of the comprehensive land reform of 1958 and the successive cooperative system were perceived as the result of the massive shortage of administrative cadres to implement them (Chapin, 1988). Semi-socialist experiments of the following Baathist regime with state farming and market intervention were regarded as the main impediments of agricultural development when a radical free market regime was envisaged in the wake of the regime change after 2003.

Iraq has great potential to significantly enhance its agricultural productivity and, therefore, increase farmer incomes, given fertile soils and appropriate water resources. The agricultural sector is managed poorly due to ineffective policies, lack of transparency and accountability, and high levels of corruption. A number of factors contribute to poor governance in the agricultural sector; this has been compounded by the fragmentation of political power and the rentier nature of the state (Abbott, 2009). There has been a wide range of legislation and policies that seek to regulate agricultural productivity in Iraq, but these policies have not produced the desired results due to the weakness of the governance system. Although Iraq's legal and institutional framework enshrines the rights of smallholders, farmers are often the first to be negatively affected whenever the government implements decisions on major projects such as large dams and irrigation systems (Roach & Al-Saidi, 2021). It is essential to transform independently founded government regulatory and policy-making powers in Iraq into institutions, creating clear and transparent governance. Under a system of good governance, regulatory systems cannot be entrusted to unaccountable organizations, since they have an overarching role that requires accountability to the general public.

There are specific reasons borne out of historical, sociopolitical, and administrative conditions that have led to weak policies in Iraq. It is due to the low quality of the bureaucracy and its failure to reform agricultural and other sectors. This, in turn, is due to instability encountered during the last four decades, especially in administration, the changing and fluctuating environment, increasing corruption, and a lack of trained staff in addition to wars. Despite economic and political changes after 2003, which opened the market, laissez-faire could not bring about the expected results because it had to find a starting point, and these points remained related to the main agencies in any sector (Kövér, 2021). All those reasons make the stability needed for farmers and for the different activities of market participants impossible and leave the uncultivated or not fully cultivated land barren and, along with the crops that are not fully grown, cause starvation and poverty. Movement towards scarcity gives traders and corrupt market participants who join the traders more opportunities to control the market and lower prices paid to farmers while selling at higher prices to consumers (Al-Ossmi & Ahmed, 2017).

Developing countries, in general, and Iraq especially, find it challenging to face the problem of dumping. First, they may not have the capacity to implement anti-dumping legislation in all the countries involved in agricultural dumping. Due to a lack of institutions, regulatory frameworks, and qualified officials. Second, developing countries do not have the same strength as developed countries to defend their interests in the context of international organizations (Dadoosh & Alomary, 2022). Thus, the Plan of Action and other documents submitted by developing countries are usually not added to the list of trade issues. As a result, international organizations usually do not address this trade problem in specific agendas. Agricultural sectors in developing countries are generally fragile and highly labor-absorbing. This explains the popular view that dumping in agricultural products has very high economic and social costs. When export prices collapse, incomes fall to barely survival levels for millions of small farmers and landless laborers, as well as for those employed in agro-processing and marketing. The affected individuals have little resilience, for example through savings, to sustain such periods of low income (Kim & Roh, 2022).

The most frequently used definition is that a product is dumped if it is exported by a firm or country to another at a price lower than the real price, or it usually prices on its home market. More practically speaking, the above definition means that exporting markets are pushing cheap domestic products into the regional market, leading to damage to local products and competition due to the extreme decline in prices offered for imported products. The prices offered in the host region are less than the costs of production, including distribution costs. Consequently, the dumpers are mainly international manufacturers trying to push local producers away in order to facilitate the way for their products to take a larger part of the local markets (Kostecki, 1991).

The major consequences of the dumping of agricultural goods are economic, social, and environmental. Economically, farms exposed to dumping and other grains face losses, leading to their migration to other occupations in search of their daily living.

Poor policy enforcement, which is exacerbated by weak governance, decreases governmental output, leading to poverty and declining commercial service sector performance (Katzman & Humud, 2016). This economic and social poverty results in a circular linkage. Lower incomes further decrease the power of farmers to bring change in the governance system through their voice to decision-makers. Declining revenues for farmers lead to declining profits in the irrigation and agricultural machinery market and even make it impossible for farmers to repay part of their loans in an economy where farmers are the main sector dominators. Further defaults negatively affect commercial banks, agricultural machinery, and tractor corporations, which transfer the defaulted farmers to the government. The accumulation of failed farmers by the government decreases the supply of government or other parties with large revenues (World Bank, 2018). At the big contract level, some companies would be liquidated or, more typically, businesses holding government contracts or working with the institutions would cut corners to repay farmers through the profit generated on the big contracts calibrated by the government.

1.2. Research Objectives

The study addresses the various challenges affecting the growth and sustainability of Iraq's agricultural sector, highlighting the need for comprehensive solutions to restore productivity and promote rural development. Key to this effort is the rehabilitation of damaged infrastructure, including farming facilities, transportation networks and irrigation systems, which is essential for improving efficiency, ensuring stable agricultural output, and supporting the livelihoods of rural communities dependent on agriculture (Muhammad & Rahim, 2024).

Additionally, the study identifies the need to address market imbalances resulting from the influx of imported agricultural goods. This situation has weakened the competitiveness of local production and destabilized the domestic agricultural economy. Creating a balanced and protective market environment is necessary for fostering investment and revitalizing local agricultural activities (Kostecki, 1991). Another significant issue is land ownership and the fragmentation

of agricultural holdings, which limit the scalability of farming operations and hinder opportunities for rural and economic development (Genat, 2021).

The study also explores innovative approaches, such as contract farming, to improve the agricultural value chain, secure stable incomes for farmers, and reduce rural unemployment (Meemken & Bellemare, 2020). The integration of advanced agricultural technologies and sustainable practices is necessary for optimizing resource use, improving crop quality, and enhancing overall productivity. These initiatives aim to align agricultural development with broader national priorities, including food security, poverty alleviation, and the advancement of sustainable development goals (Bishay, 2003).

However, existing strategies aimed at increasing agricultural productivity raise concerns regarding their impact on the agricultural industry critical for future food security (Demsetz, 1967). Some researchers have indicated that current regulations and policies do not significantly affect positively smallholders or the family sector, particularly concerning transaction costs. The existing system is perceived to increase transaction costs, which affects both local farmers and external investors, leading to a call for protectionist policies on imported goods (Kostecki, 1991). Furthermore, there are challenges related to ineffective border control, resulting in issues with smuggled goods (Dadoosh & Alomary, 2022).

The issues at hand extend beyond rehabilitating the land, equipment, irrigation systems, research facilities, and/or new economic policies; they encompass the broader goal of restoring social trust and rebuilding community ties that have been severely disrupted by displacement and persecution. Furthermore, it is crucial to establish legislation that thoroughly assesses the potential side effects of policy decisions. Numerous aspects of the agricultural sector require urgent reassessment. This research underscores the critical issues affecting productivity that demand immediate attention and resolution. The regime and the regional instability conflicts have directed against all types of agricultural development, requiring vast additional investments for the completion of infrastructure and the rehabilitation of destroyed agricultural facilities, as well as the establishment of new ones in different agricultural chains from production in farms to the selling of this production to the

markets (Roach & Al-Saidi, 2021). Sectoral diversification is a long-term economic target for policy makers and planners in Iraq as in all other oil rich countries in the Middle East. While most other oil exporting countries focus on the development of manufacturing and services sectors in order to diversify their economies, the agricultural sector always had a high priority in development policy in Iraq.

Due to the relatively large population of around 42.9 million, with 29.2% living in rural areas, promotion and support of agriculture is not only conceived as key instruments for job creation and for raising the living standards of the poor. They are also considered as suitable tools to enhance food production in order to sustain the workforce, reduce import dependency, to initiate and foster the food industry, and to contribute to sustainable economic development (Ministry of Planning, 2018).

The hypothesis to be investigated in this research posits that the weak growth of Iraq's agricultural sector stems from ineffective policies, deteriorated infrastructure, prolonged conflict, and insufficient investment in technology and human resources. These factors collectively hinder productivity and limit the sector's contribution to the national economy. Based on this hypothesis, the research seeks to address the question: What are the primary factors contributing to the weak growth of Iraq's agricultural sector, and how can these challenges be mitigated to enhance productivity and economic contribution?

1.3. Methodology

Growth diagnostics is an approach to address the key constraints faced by a country in achieving a higher growth path based on a detailed examination of the nature of the constraints through empirical research. As new challenges emerged, policymaking in many areas gradually evolved away from recommending specific policy instruments. Emphasizing broader approaches, economic strategy now exists with a variety of instruments and their associated constraints. Just as preferences, physical capital intensity, labor market characteristics, and attitudes and cultures vary from one society to another, the constraints on investments and growth also vary; that's why a one-size-fits-all aid approach is a losing proposition

(Agrawal et al., 2024). Growth diagnostics, as a methodology, has evolved over time, incorporating a range of stakeholders' interests (Das & Kannadhasan, 2020; Kumar & Ramachandran, 2021).

In a comprehensive manner, growth diagnostics has been understood to involve the creation of a diagnosis that identifies the constraints to economic growth and indicates feasible policy paths to overcome these constraints (Usman et al., 2024). The basic motivation for growth diagnostics is the hypothesis that the ultimate sources of growth are so closely linked to the specifics of individual economies that it is impossible to develop a truly general theory of growth at a level of aggregation. Hence, the concentration on identifying economic growth constraints is consistent with the focus on economic context in alternative interpretations (Jahanger et al., 2022).

The guidance and indicators identified in growth diagnostics are thereby somewhat different from those identified either in other development blueprints based on a generalized economic growth theory or in the project-based investment appraisal inherited from the new welfare economics. The development of growth diagnostics has also involved integrating tools reflective of long-standing economic growth theory as well as more modern econometric techniques (Okitasari & Katramiz, 2022). The relative importance of these tools has varied over time and also across different interpretations. Growth diagnostics were largely developed on a trial-and-error basis. The large reliance on development tools in growth diagnostics makes it somewhat 'yesterday's' tool, although it is indicated why growth diagnostics is still relevant in today's economic climate.

1.3.1. Growth Diagnostics as a Sectoral Approach: from Washington Consensus to Growth Diagnostics

The deficit of capacities for comprehensive economic planning and reform is, however, not a problem specific to Iraq but a pretty widespread issue in many developing countries. The corresponding poor planning and reform experiences of those countries in former decades gave birth to an alternative approach among economists in recent years, namely to the so-called Growth Diagnostics.

The fundamental economic problem is that there are multiple needs and limited resources. Governments around the world, especially in developing countries, face this problem. In this case, it is logically better to make policies that ease the constraints imposed by these problems. This is undoubtedly better regarding cost and effort than trying to achieve all goals simultaneously. On this basis, growth strategies require a high sense of priorities, in other words: By focusing reform efforts on the most binding constraints of sectoral or overall growth in an economy, i.e., by identifying the main bottlenecks and lifting them, the management capacities of that country might be more effectively used. Furthermore, the problem of unanticipated distortions created by an extensive reform program might be avoided. Indeed, the problem of poorly coordinated and often mutually exclusive reform programs of different ministries and agencies have very often been a serious plague of extensive reform programs in Iraqi agriculture (Okitasari & Katramiz, 2022). It is essential that any agricultural sector reform programme focus on solving a limited number of specific problems that have been identified as the most pressing constraints to sectoral development. The design and the implementation arrangements of such a program should be clear-cut, lucid and transparent in order to facilitate the monitoring and evaluation procedures, and to identify the need for corrections in a timely manner. The main challenges for the design of such a reform program are, first, the identification of the most binding constraints of growth of the sector; secondly, to design the appropriate reform measures; and, thirdly, to define the most efficient methods of implementing them. These challenges are dealt with in the literature on Growth Diagnostics as mentioned above, which will be referred to in this research (Meléndez Arjona & Harker, 2008). It is also to analyze in the light of the Growth Diagnostics approach, the most binding growth constraints in the Iraqi agricultural sector and to discuss the appropriate reform measures to alleviate those constraints. It is based, in addition to the relevant literature and Iraqi and international data bases, on interviews with stockholders of agriculture from different administrative levels, including senior employees in the Ministry of Agriculture, from the Iraqi Central Bank, Iraq Central Organization for Statistics and Information, academics at Iraqi universities as well as businessmen and farmers.

Economic development as a research area became one of the favorite topics of economists since World War II as a number of former colonies achieved independence and their governments were concerned with fulfilling the economic demands of their populations in order to foster the legitimacy of their statehood. Since then, a huge number of theories and prescriptions emerged which attempted to assist policymakers in developing countries to bring about economic growth and social progress (Streeten, 1959). Although the related corpus of literature is dominated by the neoclassical growth theory and its variations, before the collapse of the Soviet Union, there were also influential heterodox flows of thought, including Marxist economics schools. Thereafter, free trade and market competition became the indisputable pillars of economic reasoning in academia and in institutions of international development assistance. The 'invisible hand' of Adam Smith was re-established as the primary promoter of economic growth and development. The policy prescription of this neoliberal orthodoxy was now to reform those institutions of economic freedom in a way that they enable the unfolding of free trade and market mechanisms on a world scale. This shift in perspective becomes truly captivating when it considers the following two statements First: "During the past forty years many developing countries have achieved progress at an impressive pace. Nonetheless, many countries have done poorly, and in some, living standards have actually fallen during the past thirty years. That is why poverty remains such a formidable problem and why substantial economic progress has yet to touch millions of people". Second: "Perhaps the clearest lesson from work on development during the past thirty years is that there is a premium on pragmatism and an open mind. Ideas that were once the conventional wisdom and which guided governments and multilateral institutions in forming their approaches to development have now been largely set aside. New ideas stress prices as signals; trade and competition as links to technological progress; and effective government as a scarce resource, to be employed sparingly and only where most needed" (World Bank, 1991).

This new paradigm has been called the Washington Consensus, which is essentially a body of views on effective strategies of development that have become associated with Washington-based institutions: the U.S. Treasury, the World Bank, and the IMF. The reform program was structured around three key policies:

stabilization, liberalization and privatization. Countries lagging in development should catch up with policy reforms in the following ten areas: "(1) fiscal discipline, (2) re-ordering public expenditure priorities, (3) tax reform, (4) liberalizing interest rates, (5) a competitive exchange rate, (6) trade liberalization, (7) liberalization of inward foreign direct investment, (8) privatization, (9) deregulation, and (10) property rights". However, "In the countries that followed Washington Consensus policies, economic growth was limited at best and disproportionately benefited those at the top" (Serra et al., 2008).

The reform experiences of those countries that followed the recommendations of the Washington Consensus have produced highly contrasting results.

There were some success stories but also big disappointments, especially in the case of least developed countries. The Washington Consensus did not provide an authentic recipe or real development programs. It was just idealistic recipes that had no connection to reality. For example, the term "tax reform". What is the recipe? Should it be a tax increase or a tax reduction? Some countries do not suffer from the tax problem but perhaps suffer from financing or have a problem with the exchange rate, which hinders the entry of foreign direct investment. In the same view, the excessive belief in market fundamentalism and the 'one-size-fits-all' reform prescriptions were the main reasons why the Washington Consensus policies were 'doomed to fail' (Serra et al., 2008). The active role of the state in a variety of industrial policies was, in contrast, the main fundament for the strong growth in East Asian countries, especially in China, Korea and Taiwan. The reform program of the Washington Consensus was later supplemented by a new set of reform proposals focused on building a solid fundament for development policies through good governance and strong institutions rendering the reform package still more divers and complex.

The criticisms of the market-centered 'fit for all' reform list of the Washington Consensus is the fundament for the two main pillars of the Growths Diagnostics approach to economic reform: First, the strong consideration of the country-specific economic, social, political and cultural conditions when designing a reform program; and second, the concentration of reform activities on a few areas in order

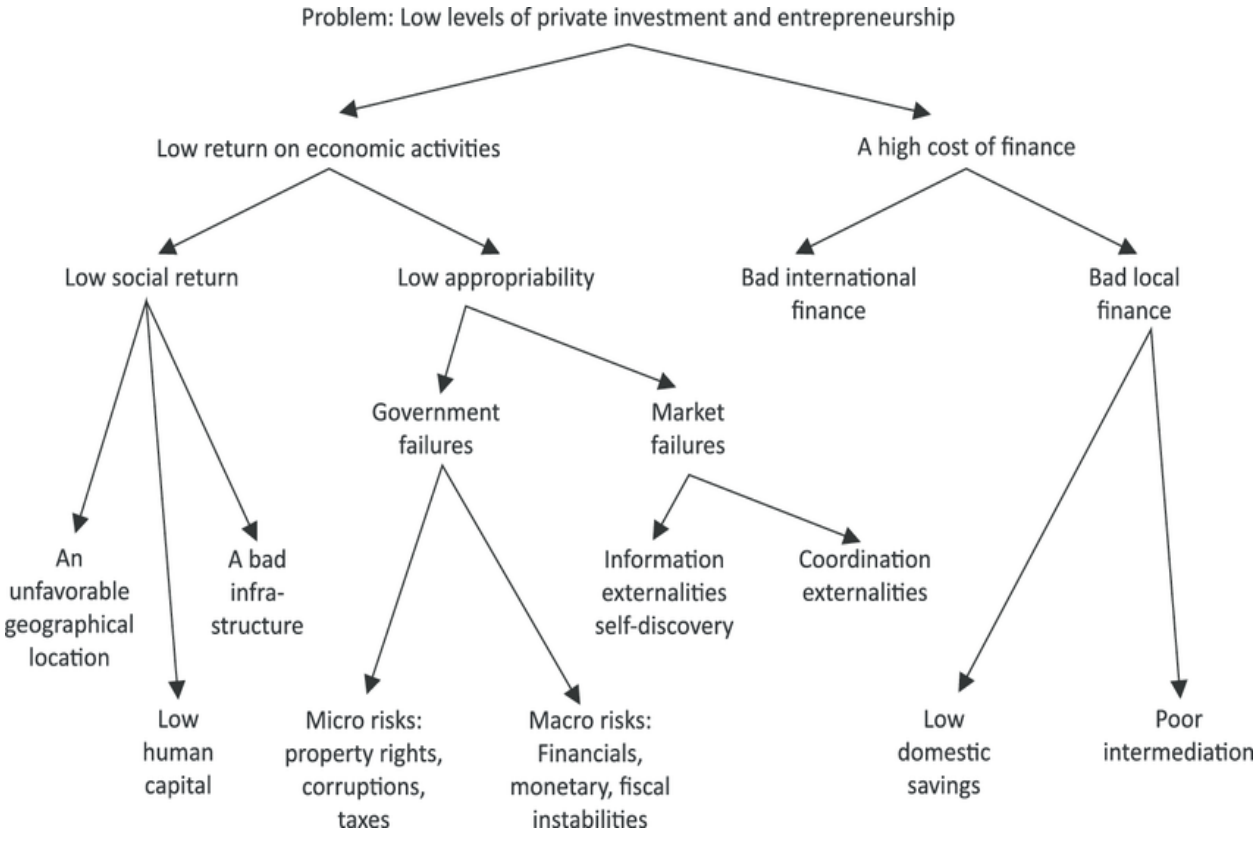
to use efficiently the financial, political and technical capacities of the government in alleviating the most binding constraints to economic growth in the country concerned. Accordingly, the identification of those most binding constraints to economic growth for the purpose of policy reforms to alleviate them is the most important aim and challenge of the Growth Diagnostics approach. It shall be noted here that the idea of higher efficiency of focused reforms in a few areas in contrast to the long list of reforms of the Washington Consensus has some parallels in the history of thought on economic development, namely in the debate on unbalanced versus balanced growth (Streeten, 1959). These pioneers of the strategy of unbalanced growth suggested the concentration of the available investment capital of developing countries on a few industrial projects with strong potential forward and backward linkages to future projects in other branches in order to spur economic growth, instead of spreading the available capital in a great number of industrial projects and risking a vanishing effect (Hirschman, 1958).

The growth diagnostic framework was first applied in 2005 in 12 empirical studies by World Bank economists to controls (Leipziger & Roberto, 2006). These country studies (Armenia, the Baltic States, Bangladesh, Bolivia, Brazil, Cambodia, Egypt, India, Madagascar, Morocco, Tanzania, and Thailand) were followed by a number of other studies, the Asian Development Bank in the Philippines, and the Inter-American Development Bank in Belize. This approach has proven to be very successful in identifying the most pressing constraints to growth, through the development rates achieved after the reforms. This demonstrates the success of this approach at least in shortening the effort and time that was spent in the past years and other development approaches. Other think tanks and research centers, such as the Millennium Challenge Corporation, have also had a significant impact on this area of research (Millennium Challenge Corporation, 2017). Although most studies attempt to analyze national economies as a whole, there are also applications of the growth diagnostic approach to subnational entities: Aceh in Indonesia, Northeastern Afghanistan (Boettiger et al., 2017).

1.3.2. The Analytical Framework of Growth Diagnostics

The analytical framework of growth diagnostics was first developed by (Hausmann et al., 2005), as a methodology to identify the most binding constraints to economic growth in a specific country at a particular point of time. In this framework, economic growth is the result of an optimization process under constraints. Assuming a simple growth model with a production function depending on factors like physical and human capital, infrastructure, geography, governance and institutions, the framework suggests the identification of binding constraints of economic growth by estimating shadow prices of those factors reflecting their scarcity. Low levels of private investment and entrepreneurship are considered as the main impediments to economic growth and the framework suggests a methodology that is based on a so-called 'decision tree' for formulating hypotheses on what may that constraining the economic growth of a specific country. As evidenced in Figure 1.

Figure 1: Growth Diagnostics Decision Tree



Source: Hausmann et al., (2008).

A later 'Mindbook' of growth diagnostics recommends starting a diagnostic exercise with a general review and analysis of the 'growth history' of a country in order to provide a context to identify the binding constraints to growth (Hausmann, et al., 2008). The writers then argue that these constraints are caused by three kinds of circumstances which are represented in the main branches of the 'decision tree': Firstly, the expected social returns on investments, which are mostly dependent on complementary factors of production like human capital or infrastructure, are low. Secondly, the expected share of the returns to investors' 'appropriability', which depends on market distortions, taxes, macroeconomic instability, corruption, or similar features in that country, is low. Thirdly, the financing of the investment is too expensive or not available. Using the 'decision tree' as a guide, the authors suggest the systematic investigation of every branch to identify potential explanations for the binding constraints of private investment and economic growth in the country in question. In this process, the high cost of finance may be explained by difficult access to international finance and or the scarcity of local credits. In the next step of the investigation, poor geographical conditions, low quality of infrastructure, deficits in human capital and other factors are to be taken into consideration as the potential causes of the low social returns, whereas market and/or government failures may be investigated as the candidates for the low private appropriability of social returns. Similarly, low domestic saving and/or poor financial intermediation are the next branches of the 'decision tree' which may be the possible causes of the scarcity of local credits. In this way, going down the 'decision tree' from branches to branches, the growth diagnostics approach attempts to identify the root causes of the low-slung levels of private investment and entrepreneurship.

By emphasizing entrepreneurship and investment deficits as the main impediments, it is clear that the growth diagnostic approach is more concerned with issues of igniting growth in stagnant less developed countries rather than issues of sustaining growth in more advanced economies. Capital accumulation in the tradition of the early writings on economic development (Rosenberg, 1961), rather than institutional reforms seems to be perceived as the main concern. From the perspective of least developed countries, new idea later that the main instrument to

bring about private sector investments is to enhance tangible returns to the economy for private investment and generation of a virtuous circle of profits and expansion of capabilities. However, aware of the need of institutional reforms in a later stage of economic growth, Regulators who want economic growth might be better off starting with the most stringent constraints on economic growth, where the returns to (Rodrik, 1999) economy are greatest rather than using scarce capital for a wide-ranging reform. Broad reforms will eventually be necessary to sustain economic growth, but they may fail because capacity runs out sooner, especially before any revenues are realized from the projects. But it may be easier and more effective to draw up sensible plans with appropriate priorities and capacity scale when the economy is already growing and its costs can be spread over time (Rodrik, 2006). The focus of the growth diagnostic approach on LDCs is by pointing out their fixed nature: This approach focuses on binding constraints at a specific time and cannot use the exact solutions to different problems in the future. However, the problematic point of several economies in developing countries that how to maintain growth performance and sustainability (Felipe et al., 2011).

The 'decision tree of growth diagnostics' Figure 1, has been widely criticized as an approach that provides a framework for formulating hypotheses about the binding constraint on growth rather than hypotheses about the empirical tools to test them. This criticism applies to the tool of measuring shadow prices of resources to identify the most pressing constraints. High shadow prices indicate scarcity of resources that may constrain economic growth. Identifying shadow prices is very difficult in practice, because in such countries data are often opaque due to corruption and inefficient statistical agencies. Even when the equilibrium price of a resource can be measured, it may not reflect its scarcity due to market distortions. In practice, we have to take into account non-price signals such as credit rationing in financial markets because this may cause credit scarcity due to low interest rates. Thus, different researchers applying the growth diagnostic methodology may reach very different conclusions.

This decision tree is a heuristic tool and should not be considered final or fundamental, as it is also necessary to rely on the literature, policies and history of those institutions to form a comprehensive view of this economy or sector.

However, the advantages of this approach are its suitability for a deeper empirical basis for the specific analysis of each case.

Growth diagnosis can be applied to a specific case, a country, a company or a sector. From this perspective, cross-country growth regressions are, in their view, primarily interested in the variables causally associated with growth in the average country. However, the country in question may not be an average country and the changes in the same variable may cause different results than in the case of the average country. On the other hand, cross-country regression analysis is based on variables available for all countries in the sample, whereas the growth diagnostics allows to cover much more information and data for the country in question than available in standardized form for a number of countries. In the same token, growth accounting as a method of analysis of the causes of economic growth is criticized for a number of reasons, including two assumptions on which its models are based and which are highly problematic in adapting to least developed countries: First, a production function with constant return to scale, and Second, perfect competition. Finally, considering international rankings as a method of measuring growth performance in a comparative manner, the issue of indicators used in indexes: 'By definition' an index is a one-dimensional measure. However, many of the key sensitive points that the index tries to measure quantitatively are rather tricky, such as the quality of institutions, the investment climate, and the degree of competition, representing very high dimensions. The construction of indexes often requires the reduction of this high dimensionality by simply taking the average of disparate components of the indicator in question by assuming their linearity and separability and mostly using arbitrary weights. The judiciary must be independent, all institutions must be interconnected. The constraint may be in supply or simply low demand, so the suitability of indicators to determine binding constraints is very limited as poor performance may be an indicator of a constraint. In conclusion, the researchers conclude that in terms of identifying the causes of binding constraints to economic growth, growth deterioration, and growth accounting, international classifications and proposals can contribute to finding a solution, but international institutions, in general, fail to reach a clear and practical approach to diagnosing and identifying the problems that may affect growth.

There are four general properties that a constraint should exhibit for it to be potentially binding. These 'principles of a differential diagnosis' are: (1) "The (shadow) price of the constraint should be high, (2) Movements in the constraint should produce significant movements in the objective function, (3) Agents in the economy should be attempting to overcome or bypass the constraint, (4) Agents less intensive in that constraint should be more likely to survive and thrive, and vice versa" (Hausmann et al., 2008).

The shadow price in the growth diagnostic approach is the basic principle for identifying binding constraints to growth. Theoretically, it is the change in the growth function by an increase of the supply of one of the resources, the marginal product of that factor. It indicates the degree to which a constraint is binding, as a high shadow price implies that relieving it would have a large effect on economic growth. In practice, shadow prices mostly are difficult to measure and market prices or other market symptoms like unmet demand may be helpful to estimate them. However, a variety of practices of private sector agents attempting to avoid the constraint in question may also be helpful to identify it and to evaluate its potential impact. Finally, considering the successful types of investment projects in the private sector may help to detect the typical constraints on the others.

Concerning the type of evidence for the analysis of binding constraints, growth diagnostics has to be pragmatic. This may be questionnaires, literature reviews, or reports issued by relevant institutions with reliable data. From this raw data, a coherent and causal story must be extracted, with intelligently collected evidence that can understand reality to formulate effective policies that address the imbalance from the roots. The accuracy of the analysis depends on the amount of information provided, i.e., a wide range of inputs, including numbers and data that reflect specific concerns or outcomes. Accurate figures on income and employment, data on social inequality, etc., are needed to shape institutional policies. This provides insight into the future impact of increasing opportunities to increase income or reduce poverty. In addition, commercial management, whether industrial or commercial, affects job creation and private business activity in growth and may also impact development in general. "The final step of the growth diagnostics is to provide a logically consistent causal chain that accounts, as much

as possible, for the facts we observe. Once we posit it, we must check its soundness by deriving other symptoms that should be present if the proposed syndrome is true. This process should be repeated until the diagnostic has settled on a well-supported identification of what the binding constraints to growth are and why they are present" (Millennium Challenge Corporation, 2017).

1.3.3. Conceptual Framework of the Growth Diagnostic

To follow the analytical method in the theory of growth diagnosis and to know the obstacles, it is necessary to follow the decision tree in Figure 1, and it is possible to match it with the reality of the Iraqi agricultural sector. Start with the left side of the tree. Low return on economic activities and then low social return, which shows the lack of infrastructure. Owing to ongoing wars and conflicts, the infrastructure has suffered significant degradation. Key components such as roads, irrigation networks, warehouses, electricity supply, and veterinary and advisory centers have mainly become inadequate. The absence of a robust road network results in crop damage during transportation to markets and leads to exorbitant transportation costs. Weak irrigation systems contribute to substantial water wastage and hinder the expansion of larger agricultural projects. A shortage of warehouses results in losses from spoilage of crops. The lack of reliable electricity impedes essential agricultural operations, such as the operation of water pumps and cold storage facilities. Additionally, the deficiencies in advisory and veterinary services complicate farmers' ability to stay abreast of global developments and address medical issues impacting livestock and crops. The fragile infrastructure results in heightened costs and diminished profitability, ultimately deterring investment in the agricultural sector.

To begin, one should move to the other side of the tree and start by addressing the areas with low appropriability. This will focus on government failures, as they represent the majority of the issues in our research. From this point, we can start discussing the necessary reforms. Importing subsidized agricultural products from abroad at low prices destroys the local market and makes Iraqi products unable to compete. One of the most significant challenges that Iraq encounters is the issue of dumping, which refers to the practice of exporting goods to Iraq at prices lower than

their fair market value. This situation often arises due to the absence of adequate regulatory policies that can protect local industries and consumers (Kim & Roh, 2022). Additionally, the limited capacity of management to devise and implement strategies to address and overcome such challenges further exacerbates this predicament. Dumping leads to a decrease in farmers' income and their exit from the market.

The lack of well-defined land ownership laws often results in ongoing disputes among farmers, as unclear guidelines create confusion over property rights and responsibilities. This ambiguity can lead to conflicts over boundaries, cultivation rights, and property usage, which disrupts the cohesion necessary for effective farming operations. Legal legislation and government guarantee for investors regarding property rights are the first link in the investment chain in any country or sector, so it is impossible to neglect this essential point that can activate the role of investment in the agricultural sector (Merebashvili & Dzamukashvili, 2024). All successful investment experiences around the world have guaranteed investors their rights and ensured that property rights are resolved in a fair and legal manner, without exploitation, bias, or the dominance of a politically dominant group over other groups.

Furthermore, the fragmentation of agricultural land into smaller, less viable plots significantly diminishes its economic efficiency (Manjunatha et al., 2013). When land is divided into tiny parcels, it limits the scale of farming activities, making it challenging to implement modern agricultural practices and investments that could enhance productivity. This fragmentation not only hampers the potential for long-term investments in land improvements but also undermines the overall viability of agricultural enterprises, ultimately affecting food production and economic stability in the region. The problem of fragmentation of agricultural land into small holdings is also a legislative one. It is better to find solutions that are compatible with the cultural and social environment. In Islamic societies, land can be reunited and made ready for production through religious legislation, perhaps (Okitasari & Katramiz, 2022). Large investments require vast areas to meet the needs of the growing market with the increase in population size. The population

of Iraq increases by approximately one million people every year, so there must be a solution that guarantees food security and work for this increasing number.

The absence of clear and comprehensive contracts between farmers and buyers significantly contributes to unpredictable price fluctuations and a general atmosphere of uncertainty in the marketing of agricultural produce. Without well-defined agreements, farmers often find themselves at the mercy of market dynamics, which can lead to sudden drops in prices and ultimately affect their income stability (Meemken & Bellemare, 2020). Moreover, the lack of a robust legal framework governing contract farming exacerbates farmers' vulnerabilities, as they have limited recourse in the event of disputes or unfavourable terms. This precarious situation can result in substantial financial losses for farmers, who may not have the capacity to absorb such shocks (Martiniello, 2021). Additionally, there is a pronounced need for better organization in agricultural production practices.

The persistent instability of both the security and regulatory environment in the country has created significant obstacles for farmers seeking to find reliable international insurance providers. This challenge is compounded by the lack of specialized insurance systems designed specifically for the agricultural sector (Adnan et al., 2020). Numerous farmers are particularly vulnerable to various risks, including natural disasters like floods and droughts, as well as unpredictable market fluctuations that can severely impact their livelihoods. Moreover, the existing financial support mechanisms are inadequate, leaving farmers with limited access to the funds they need to acquire essential equipment and tools necessary for their operations. When disasters strike agricultural crops, whether due to natural causes or destructive human activities, the state often does not have to compensate farmers for their losses. The current system is a fragile legal, legislative, and regulatory system that makes producers unable to cope with market fluctuations and disasters (Khalili et al., 2024). This leads to a mass exit of producers from the market. This shortage not only hampers their ability to secure their crops against potential threats but also stifles overall agricultural development and growth within the region. As a result, the agricultural community remains at a disadvantage, struggling to adapt to the complexities of both environmental and economic uncertainties.

There is a notable underutilization of modern technology, including smart irrigation systems and precision agriculture techniques. Additionally, there is a lack of training programs designed to equip farmers with the necessary skills to operate modern equipment effectively (Dhanaraju et al., 2022). Furthermore, the high cost of technology poses a significant barrier, making it inaccessible for many farmers. The necessity of integrating technology and innovative farming practices is indisputable, as it establishes a framework for enhancing agricultural production processes. This integration enables stakeholders to identify and implement best practices by analyzing data related to farms and yield outputs. The primary focuses of technology in agriculture include improving efficiency, increasing productivity, and expanding agribusiness opportunities, all of which have significant implications for the sector. In the context of Iraq, the application of technology can address several pressing challenges that the agricultural sector faces which are unfortunately deteriorating (Boursianis et al., 2022). These technological solutions have the potential to facilitate a transformation within Iraq's agricultural landscape, promoting a shift towards a more productive and innovative industry through the principles of sustainable development and environmental conservation. In the next section, other causes will be analyzed and linked to the results. To know the roots of each problem in the agricultural sector and try to find solutions.

1.4. The Structure of the Study

This study is divided into four chapters and two appendices. Each chapter addresses an obstacle to growth in Iraqi agriculture. The chapters are distributed according to priority. The first chapter addresses the infrastructure of the agricultural sector that has collapsed due to wars and terrorist attacks, especially in recent years in the northern regions of Iraq. This research focuses on the possibility of rehabilitating the infrastructure in minority areas in northern Iraq, which were occupied by ISIS in 2014-2017. The agricultural infrastructure was destroyed and the population was displaced, most of whom depend on agriculture as their only source of livelihood. ISIS had a devastating impact on Iraqi agriculture. As it started to take over territory in Iraq, its more than 4000 inhabitants attacked the rural infrastructure. The conflict significantly reduced agricultural production in 2014, slightly decreased it in 2015, and significantly dented it in 2016. The short-term focus of the crisis overlooked the

interaction between misgovernance, violence, decline of soil fertility, dependence on wheat and barley varieties prone to disease, poor access to certified seeds, and the low dissemination of modern agricultural technologies, which had cumulatively hampered the potential broad-based development of Iraqi agriculture. Many farms were burned, machinery and other fixed assets were destroyed, domestic animals were stolen, and irrigation facilities were heavily affected during the turn of the conflict or just afterward. Landmines and the threat of violent clashes have undermined or denied access and movement of farmers, laborers, and herders, creating 'distressed' zones within the villages. In the best case, people have been displaced; in the worst, people lost their lives or are missing. The displacement of households and factions left 12% of the Iraqi workforce jobless in 2016. The rural population lost their fixed assets and fled the area, and the direct impact of the invasion has seen the region so far feed its basic needs through food traded over from the trading routes and humanitarian assistance, including food aid. In particular, food security issues have surged within the internally displaced persons hosting areas where the agricultural transformation failed to provide matching employment opportunities in the sector.

This chapter attempts to fill the gap in scientific research, as research often deals with the technical aspect of rehabilitation and ignores or basically neglects the social aspect and its role in restoring community ties and cohesion that would be capable of rehabilitation and production. Rehabilitating physical infrastructure must precede social reconstruction, overcome all obstacles, and begin restoring pre-war normalcy. It is impossible to focus on restoring physical infrastructure without considering the social challenges that hinder this development. The incidents of kidnapping, killing, and displacement that residents of northern Iraq have experienced may hinder the restoration of community trust, reconstruction, and investment. While reviewing possible rehabilitation mechanisms to achieve sustainable agricultural recovery, models of successful reconstruction programs in conflict-affected areas are presented, providing social, financial, and technical support to farmers and improving agricultural-related infrastructure. This chapter also contributes to understanding how the Iraqi government and the international community can develop effective strategies to support affected areas, contributing to social and economic stability and increasing agricultural productivity.

The second chapter examines the importance of laws that must be studied and adopted to regulate international trade and prevent the entry of foreign goods in quantities that affect local production. The dumping of agricultural commodities in Iraq has greatly affected agricultural production, forcing a large number of local producers out of the market, and the Iraqi market's dependence on foreign agricultural products. This study analyzed using The Autoregressive Distributed Lag (ARDL) methodology for series from 2000 to 2020 to analyze annual data and discover the short- and long-term impact of imports on Iraqi agricultural production. The results showed that increased imports reduce production and push local producers out of the market, especially in food products. One of the biggest constraints to agricultural production in Iraq is the high level of commodity dumping, which constitutes a major challenge that hinders competition for production, leading to lower prices and weakening production incentives. This chapter also discusses possible policies to protect farmers, such as imposing tariffs, supporting local agricultural products, and encouraging investments in agricultural value chains. This chapter represents a vital contribution to the debate on agricultural trade policies in Iraq, proposing practical solutions to combat trade dumping and enhance food independence.

The vast amount of imported goods that were recently and currently infiltrating the Iraqi markets is commonly known as goods dumping. Overall, such a phenomenon has three major effects on the Iraqi agricultural sector as a whole. First, locally made goods become unfairly expensive compared with their easily purchased counterparts. This makes individuals more inclined to buy the much cheaper items. Second, local farmers may no longer be willing to farm, as these goods are now flooding the local markets. For a farmer anywhere in this country, it becomes a dilemma: why should they spend the effort and the capital needed to produce something with a price not too different from the imported goods available at the market just around the corner. It will be much easier to just let go of the farm and, instead, either import the goods or get a job somewhere else. Obviously, the issue here lies in the price tag of the goods. Third, many farmers will be entering a vicious circle. The more goods and services are dumped the market, the more likely the market price of these goods. For the farmers, less money coming in could mean that they may no longer be able to buy new seeds, fertilizer, and equipment, among other things. Furthermore, the low income will potentially lead to closing off lands, stopping the farming life, and pushing individuals

in agribusiness and other related sectors into an inflationary arena. Overall, it is becoming quite clear that dumping is starting to seriously affect the Iraqi agriculture supply chain. The issue has also been worrying stakeholders, as it represents a clear and flagrant violation regarding food sovereignty and food security dimensions in a country such as Iraq. Finally, it is a must that developing countries such as Iraq should enact anti-dumping protective strategies, not only to avoid further homelessness and poverty problems, but also to guarantee their local producers a normal trade for a better investment environment of the agricultural sector in Iraq.

The third chapter addresses the issue of laws and legislation that must be developed to enable producers to contract with buyers to facilitate the marketing and production process. This chapter explores the benefits of contract farming in marketing, price stability, production stability, and clarity of the agricultural plan with production quantity according to demand. Contract farming is the best investment tool as the buyer provides financial facilities, technology input, risk insurance, scientific research, agricultural plan, seed or animal varieties, and even dates. The producer only implements according to the contract and the project is risk-free due to the insurance that bears all risks. The research explores the challenges facing the implementation of this project, such as poor infrastructure, legislative and legal frameworks that would protect contractors. The impetus behind contracting originates from the difficulties both the private and public sectors face in the provision of administrative services, agricultural inputs, extension, finance, and post-harvest services. Farmers' problems include acquiring inputs, extension advice, and credit on time; getting favorable credit terms; selling produce at a fair price; and investing in appropriate on-farm facilities and technology. Agencies with local knowledge exist but are not sustainable in their present form. Contract farming is a quasi-subsistence economic activity. Farm households are skillful but invest little in the farm because of current price, marketing, and policy vulnerability problems. These problems can, in part, be traced to the legacy of past government policies and regulations. These stifled farm investment, product marketing, and distorted input and product prices, and food aid. Though many farmers face a very weak set of public and private institutions, to a large extent, they have not established alternative channels to respond to these weaknesses.

The large public sector, despite much possibility, has not been able to address all the constraints. The changes imposed are bound to cause an upheaval and will create opportunities. They would go a long way towards putting much of the nascent growth in the subsector on a more sound economic and institutional foundation. Despite the obstacles, the possibility of implementing this idea is very high by starting with producing the material that the farmer has a comparative advantage in producing and then moving on to more complex projects after learning and adapting. The most effective modern mechanisms for agricultural production and investment promotion is contract farming, as it provides guarantees, insurance, and regulatory and legal frameworks that ensure production and protect the rights of investors and producers. This chapter examines the ability of contract farming to secure, finance, and sustain agricultural supply chains and organize production. Food security is achieved by increasing production through contractual organization. This research also reviews successful experiences of other countries that have implemented contract farming to bridge the production gap and increase investment. This addresses one of the biggest challenges facing the Iraqi agricultural sector.

The fourth chapter examines the possibility of applying technology and the internet of things to Iraqi agriculture and training and education for farmers so that agricultural associations and the state can take the first step towards technology. Inefficient management of scarce resources in the production process leads to increased costs. To meet the growing demand for agricultural products and services in the Iraqi market, which is projected to have a population of approximately 42.9 million in 2024, there is a clear need for investment in smart management practices. The study shows that adopting the Internet of Things (IoT) can significantly enhance resource management, reduce costs, and improve returns. Key benefits include optimal water usage, reduced pesticide application, and better disease management. However, the widespread adoption of these technologies is hindered by high initial costs, a lack of expertise, market uncertainties, and insufficient data. Implementing modern technologies and an Internet-based farm management system requires both infrastructure investment and extensive education for farmers and project owners.

This training is crucial for ensuring the seamless integration of these systems and facilitating the operation of agricultural projects. One of the most effective modern approaches to enhancing agricultural production and attracting investment is contract farming, as it provides guarantees, insurance, and regulatory and legal frameworks that safeguard production and protect the rights of both investors and farmers. This chapter explores the capacity of contract farming to secure financing, sustain agricultural supply chains, and organize production. Achieving food security through increased production is closely linked to contractual arrangements. Additionally, this research reviews successful experiences from other countries that have implemented contract farming to close the production gap and boost investment, addressing one of the major challenges facing Iraq's agricultural sector.

The first appendix examines the fragmentation of agricultural holdings, which reduces production due to poor yields in small areas for many reasons, including the inability to apply technology to small areas. The research in the first appendix applies endowment as a solution to consolidate agricultural lands. The Islamic world suffers from the problem of fragmentation of agricultural holdings into small, unproductive plots. Fragmentation of land leads to a decrease in production due to several factors, the most important of which is the lack of investment in small areas and the scarcity of products, which makes their marketing difficult. Also, purchasing expensive technology and equipment is not economically feasible for these small projects, in addition to the difficulty of obtaining loans for the same reason. One of the biggest reasons for this fragmentation is the Islamic inheritance law, as the inheritance law divides the shares of land and wealth and ends most successful projects. This problem has not been resolved and we have not found many literary reviews that address this gap. Hundreds of years ago, Islamic jurisprudence proposed a good principle for keeping the lands, waqf (endowment), Imprisonment and prevention of sale and division. This mechanism has been very successful in stopping land fragmentation, and this type of land has also seen an increase in production. One-way analysis of variance (ANOVA) was used to study the statistical differences in the quantity of wheat production per hectare and operational costs between fragmented lands, large-area endowment lands, and lands owned by individuals to find out if there were statistically significant differences for all of these types.

An innovative way to address the fragmentation of agricultural land is to implement Waqf. This approach can be leveraged as an investment model to achieve development and sustainability. This appendix reviews how Waqf lands are utilized to increase production through sustainable management. This appendix also reviews the experiences of other countries in using this model to increase production and reduce the fragmentation of agricultural land, and discusses the feasibility of implementing this model in Iraq. This research contributes to achieving sustainable production and self-sufficiency due to the impossibility of re-fragmentation of agricultural land, which benefits the Iraqi economy.

The second appendix is about property rights in agricultural lands. It studies the possibility of applying justice in land distribution and also benefiting from other experiences in property laws to attract investment and increase agricultural production. The agricultural sector in Iraq faces significant development challenges due to the current land ownership system, which is marred by property conflicts and political instability. Reforming this system is crucial for increasing investment, boosting production, and achieving sustainable development. This qualitative study examines the economic and legal policies related to land ownership, utilizing extensive literature to suggest comprehensive reforms that create an investment-friendly environment and ensure equitable land distribution. It highlights the successful experience of Albania, which improved agricultural production by adopting a hybrid system that balances sector support with privatization and conflict resolution. The study aims to provide Iraq with insights from this model in order to promote sustainable growth. Addressing ownership issues through deep economic and legal reforms could significantly enhance agricultural production and improve food security in Iraq.

This part of the dissertation proposes to enact modern laws regulating land ownership to attract investments, drawing on international experiences of countries that have faced political and historical challenges similar to Iraq while developing a legal framework that encourages real estate stability and guarantees the rights of owners and investors. This integrated approach relies on a sequence of legislative priorities to ensure the efficient use of resources and the desired impact on the

agricultural sector in Iraq. Land ownership and tenure laws are one of the most important laws that can attract investment, and to achieve efficiency and sustainability in agricultural production, stakeholders must be involved in achieving a more efficient livelihood system. In this paper, studied the possibility of benefiting from Albania's experience in the property system and how its system contributed to attracting investment and reducing conflicts, especially since Albania has historically witnessed a political transformation similar to Iraq. Albania and Iraq shared a very similar tenure system due to the close political history, as both countries lived under Ottoman occupation for a long time and used the same

Albania's successful transition from a socialist land ownership model to a market-oriented system offers valuable lessons for Iraq, especially in the areas of legal clarity, international cooperation, and community participation. By adopting best practices from Albania and adapting them to its unique context, Iraq has the potential to overcome land tenure challenges and enhance agricultural productivity. The study concludes that agricultural reforms in Iraq should focus on establishing transparent property laws, ensuring equitable land distribution, and providing incentives for rural investment. In addition, integrating digital technologies into land registration, coupled with strong institutional support, is essential to creating a more secure and efficient land tenure system. While the challenges are significant, especially in light of Iraq's complex social and political landscape, the Albanian model provides a promising framework for reform. Finally, the research emphasizes the importance of long-term political commitment and the engagement of all stakeholders in the reform process. Creating a good system and laws to protect property helps increase investment in the agricultural sector and also creates a cohesive and conflict-free social environment.

The importance of the land ownership system reforming in Iraq stems from the importance of development, increased agricultural investment, and stability. There are social, legislative, and administrative challenges and conflicts over land ownership that disrupt the use of agricultural land, resulting in inefficient production. This appendix offers sound solutions by drawing on other experiences across the historical sequence to address the accumulated problems of the reform process, thus enhancing production and, consequently, sustainable food security.

2. Rehabilitation of the agricultural sector in conflict-affected areas: The case of the Yazidi areas in Iraq after the ISIS crisis

Rehabilitation of the Agricultural Sector in Conflict-Affected Areas: The Case of the Yazidi Areas in Iraq After the ISIS Crisis

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Abstract

The agricultural sector in Iraq, particularly in areas inhabited by social minorities such as the Yazidis, faces severe crises due to the destruction of infrastructure during the ISIS crisis. This crisis led to mass displacement, the collapse of agricultural production, and a significant decline in financial resources. Despite ongoing efforts to rebuild these regions, the most significant challenge remains how to ensure the sustainability of these efforts. The problem is not only about rehabilitating land and equipment but also about restoring social trust and rebuilding the community bonds that were severely impacted by displacement and persecution.

Previous writings often fail to address this crisis comprehensively because they focus only on technical or economic solutions, ignoring the critical social and psychological dimensions that play a central role in the success of rehabilitation. Therefore, this research seeks to answer a fundamental question: How can the agricultural sector in minority areas be rehabilitated post-conflict, and what are the key factors to ensure the sustainability of these efforts?

This research aims to provide a comprehensive analysis of the rehabilitation of the agricultural sector in conflict-affected areas in northern Iraq, with a focus on Yazidi-inhabited regions. The research highlights the severe destruction of agricultural infrastructure and the impact of conflict on agricultural production. It is estimated that 67% of the agricultural infrastructure was destroyed during ISIS control, leading to a significant decline in agricultural output. The study uses a combination of field data analysis and literature review to propose holistic solutions, focusing on strategies that integrate social and psychological support with infrastructure reconstruction.

This research addresses the gap in studies that combine the social and technical aspects of reconstruction, offering a comprehensive model that focuses on rebuilding trust among farmers by providing training and psychological support alongside infrastructure repair. In conclusion, the recovery of agriculture in these areas can only be achieved through an integrated approach that considers social, psychological, and technical dimensions to ensure sustainable agricultural production, food security, and social stability.

1. Introduction

The rehabilitation of the agricultural sector in conflict-affected areas is critical not only for restoring agricultural production but also for rebuilding communities and providing social and economic stability. This study focuses on the Yazidi regions in northern Iraq, which suffered destruction and displacement due to ISIS control. By drawing on international reconstruction experiences, this study aims to present practical and sustainable solutions for rebuilding agricultural infrastructure, with a focus on fostering trust within local communities through integrated social and psychological support.

There is abundant literature showing that rural development is more effective than urban development in poverty reduction. The great challenge in development cooperation is how to guarantee this rural development in areas afflicted by armed conflicts (Guo & Liu, 2021). This article tries to respond to this specific challenge and can be used as a reference when developing programs aimed at agricultural and livestock production rehabilitation. This is done by analyzing the first projects carried out by the Spanish Agency for International Development Cooperation in Iraq after the bloody conflict triggered by the Islamic State in 2014. Specifically, this paper describes the case of the Yazidis in Sinjar, a minority deeply related to the agricultural world, which for centuries has managed to maintain possession of their land (Chao et al., 2021). Data from the Food and Agriculture Organization (FAO) indicates that wheat production in Yazidi areas decreased by 40% during the conflict, highlighting the significant impact of the crisis on the agricultural sector. Additionally, field data shows that most farmers face a shortage of agricultural equipment and quality seeds, which has severely limited their ability to resume farming activities post-conflict (FAO, 2017).

In armed conflict, one of the consequences of violence comes from how families are forced to leave behind their land. This has an intermediate and long-term negative effect on peace building. Families that are animal or land owners are likely to create strong ties to the land and the care that comes with ownership (Garry & Checchi, 2020). Given that these groups form a majority of the potential returnees in many war-affected areas, urgent measures are critical in the planning of land involvement in the process of rebuilding peace in which agricultural, livestock, and other livelihood activities are reactivated (Sanbar, 2020). The

aim must be to help those who are already living back home and to those who want to return soon to their home, following the idea that agricultural livelihoods definitely improve creative conflict behavior and creating hope for the future (Sanbar2020). Previous literature highlights that rebuilding the agricultural sector in conflict zones is a complex challenge that requires multi-dimensional strategies. For example, studies in Syria and Afghanistan have shown that agricultural interventions combining infrastructure reconstruction with social support yield better long-term results (Roach & Al-Saidi, 2021). Furthermore, international experiences emphasize the importance of empowering local communities through agricultural training and capacity-building programs, which help sustain reconstruction efforts (Bourhrous et al., 2022).

The conflict in the Middle East started with the Arab Spring revolutions and has evolved into an extremely complex regional crisis, with actors such as Daesh, the Kurdish government, the international coalition, the Syrian government, and the Iranian government (Bayat, 2021). During the crisis, the Islamic State was able to occupy cities and govern for two years, thereby radicalizing a vulnerable society, effectively bringing a self-selected group of foreigners, and executing minorities, including the Yazidis (Usman, 2021). The potential to attract foreign support to work in their own territory, combined with expectations of resource income, also explains why dozens of armed groups exist, competing with extremists and financed by capricious donors with different priorities, constrained the actions of host governments (Hamadamin et al., 2022).

Since the beginning of the conflict, many civilians have been killed and wounded, tens of thousands of minority groups have been displaced and forced on the mountain, leaving their homes and agricultural land unattended. The agricultural sector in post-crisis Yazidi villages is in poor condition (Acar, 2023). An insufficient number of people with the relevant technical skills in the field, the possibility of poor-quality seeds and agricultural inputs due to their high costs, the culture and attitudes developed during forced displacement to IDP camps, and the developed transfer conditions in the form of subsistence are some of the challenges that the population faces. The region is still at a very low-income level, and group homes are located in isolated areas. Their members want to

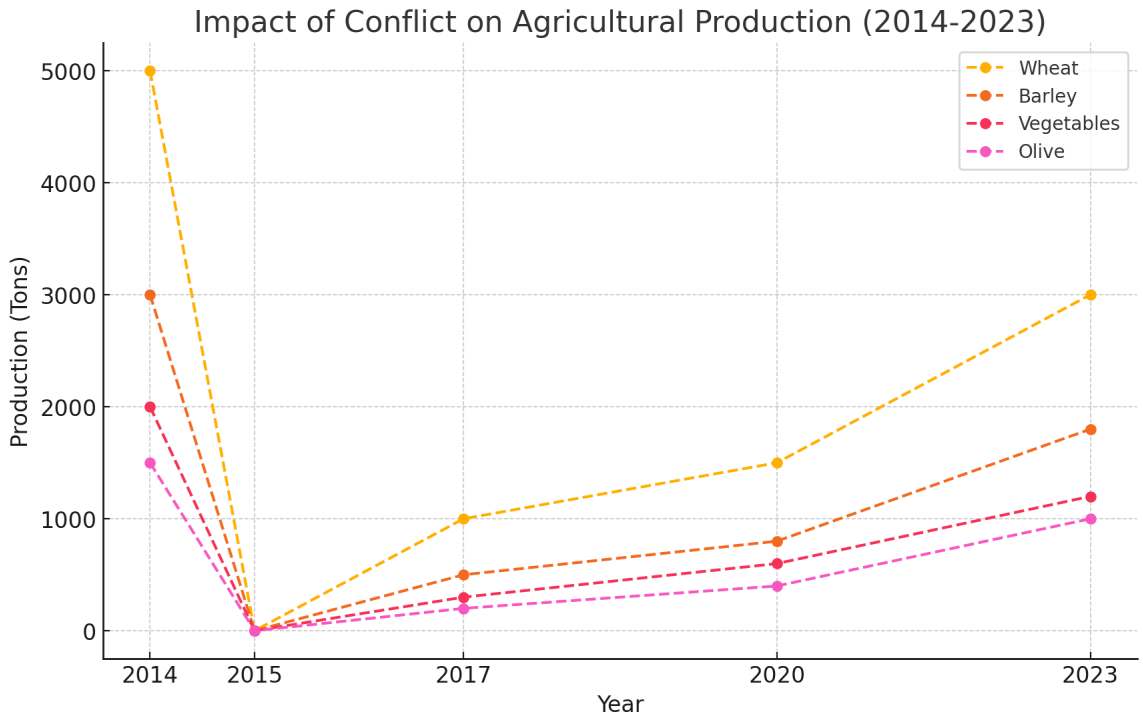
stay in the village, and according to the information received, work with animals and agricultural land would be an acceptable occupation for them (Hosseini, 2020).

2.1. Impact of Conflict on the Agricultural Sector

Agriculture is a key sector for ensuring food security and rural poverty reduction in countries. The sector is characterized by a wide range of goods and services and potentially contributes as the engine for economic growth, especially in rural areas. It provides raw materials and acts as a market for various enterprises and service providers (mechanization, pest control, marketing, storage, and transport). It is also an important employer, even outside the growing season, and provides syntropic ecological services. Of the eight Millennium Development Goals (MDGs), poverty reduction is a global goal and guaranteeing food and nutrition security is a recognized goal related to the eradication of extreme poverty and hunger (George & Adelaja, 2022; Adelaja & George, 2021).

However, the effect of conflict and war on the agricultural sector is overwhelming and leads to a lower contribution of the agricultural sector to GDP. Impact of Conflict on Agricultural Production (2014-2023): Figure 1, displays the decline and gradual recovery of production for wheat, barley, vegetables, and olive crops from 2014 to 2023. Due to low market demand, reduced yield sales, import restrictions, higher turnover costs, and lower productivity. Phase I of the ISIS conflict (June, 2014) in Iraq and the Syrian Arab Republic aimed to eliminate small family businesses that, despite being small, played a cornerstone role in the systems above (Araujo et al., 2024; Ali & Aljawareen, 2023). Community businesses that included agriculture appeared marginalized and unattractive to both ISIS and the US-led coalition that responded to the calls of the Shiite religious authority in Najaf to protect the country's territorial integrity (Aziz, 2021).

Figure 1: The impact of conflict on Agriculture Production (2014-2023)



Source: Authors' own elaboration based on International Fund for Agricultural Development (IFAD). (2019). FAO (2020), World Bank. (2023), Lele, U., & Agarwal, A. (2021).

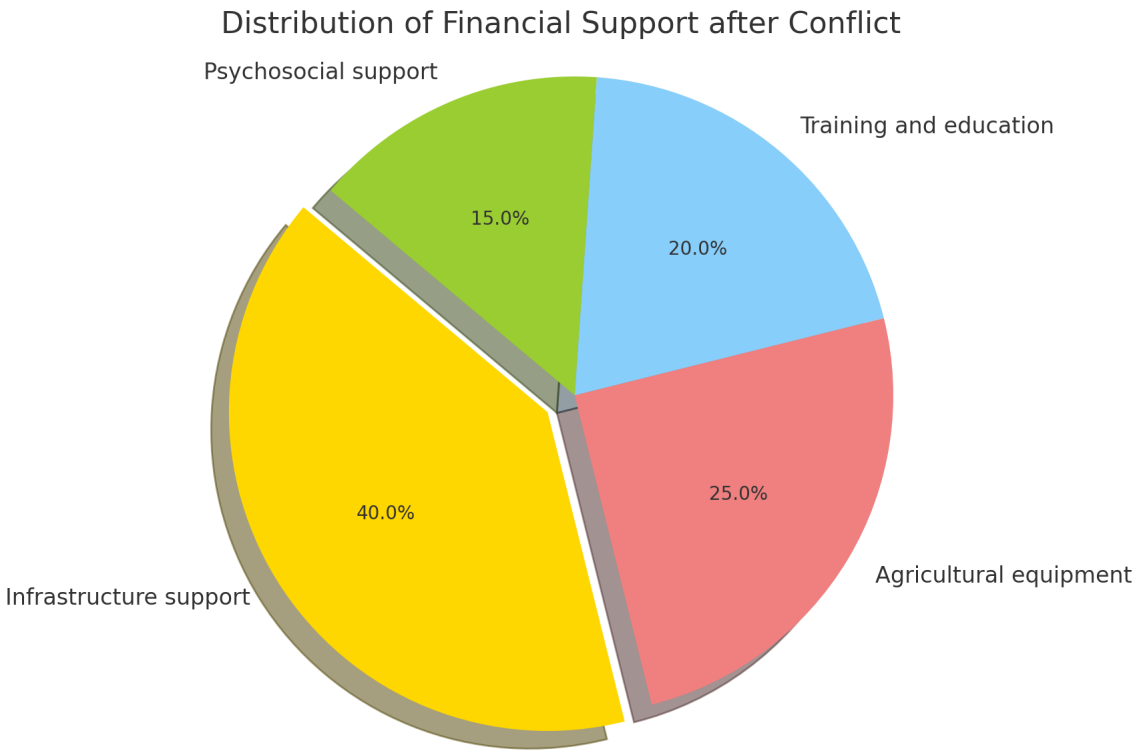
2.2. Destruction of Infrastructure

Because of the activities of ISIS, agriculture in all Yazidi areas in Iraq came to a standstill in 2015. This was due to the displacement of all the people from their homes, leaving no one to cultivate the land, repair irrigation infrastructure, or take care of their agricultural machinery (Gellersen et al., 2021). ISIS burnt, stole, or destroyed about 67% of the agricultural machinery and irrigation infrastructure in their areas, as well as approximately 40% of the residential buildings. They also cut off the flow of irrigation water from Mesopotamia. Furthermore, the flow of irrigation water was further reduced due to disputes between the Kurdistan Regional Government and the central government of Iraq at that time (Khuder, 2023).

The destruction of infrastructure was carried out through deliberate fires, accidents, and looting. This resulted in the destruction of irrigation channels at multiple points, requiring workers to rebuild and repair them in the summer of 2017. ISIS militants partially

destroyed all available state-owned irrigation machinery and equipment. They punctured rubber tires, destroyed engines, and cut exposed electrical wiring on machines such as pipe pumps and cranes. This destruction of agricultural machinery and irrigation infrastructure led to a decrease in the Surface Irrigation Supply Reliability Index for the Yazidi areas of Sinjar and Makhmour, as shown in Figure 2. This shows the distribution of financial support after the conflict, illustrating how funds were allocated between infrastructure support, agricultural equipment, training and education, and psychosocial support. This reduction caused people to hesitate in investing in agricultural infrastructure before 2017. They were unsure if ISIS would be defeated, if the Yazidi areas would be designated as disputed areas by government authorities, or even if the fighting between the new authorities and ISIS would come to an end.

Figure 2: The Distribution of Financial Support after Conflict



Source: Authors' own elaboration based on (2019). FAO (2020), World Bank. (2023), Lele, U., & Agarwal, A. (2021).

2.3. Displacement of Farmers

The ISIS crisis and its repercussions brought about massive internal displacement and severely affected the agrarian socioeconomic activities of the Yazidi population. Despite the importance of the agricultural sector to the overall economy of Shingal, to date, there are few academic articles that discuss the post-ISIS impact on agriculture, and plenty of these are based on the authors' observations (Shammo et al., 2022). The displacement deprived many Yazidis of their main source of sustenance. The UN Food and Agriculture Organization (FAO) reported that the situation of food security and livelihoods in Iraq became critical during the ISIS crisis. Displacement of rural households by conflict affected both their farming systems and their rural livelihoods (Sadiddin et al., 2023).

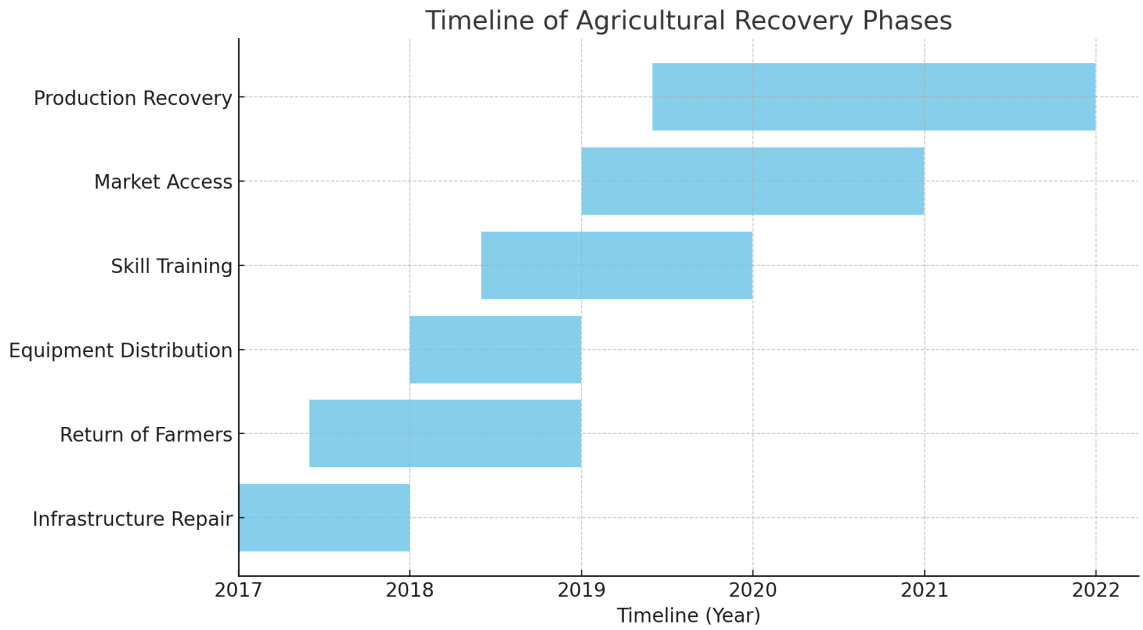
Not only crop production but also agricultural activities were affected during displacement. As for agriculture, the employment mains of agriculture, consisting of both agricultural activity and non-agricultural jobs, such as marketing, transportation, and non-agricultural labor, need to be researched. It is therefore necessary to qualitatively grasp these impacts from the perspective of the labor participation rate in the agricultural sector, including non-agricultural jobs. Such integrated studies will provide insight into the livelihood transitions from agriculture to non-agriculture in conflict-affected areas. Therefore, explanations about the impact of conflict on the agricultural labor force are necessary (Vos et al., 2020; George & Adelaja, 2022).

3.1. Rehabilitation Strategies

The rehabilitation of land, irrigation, and agricultural infrastructure typically involves both the return of Yazidis and their communities and investment by the public and private sectors in infrastructure that supports agriculture and social and economic development in Sinjar. (Alkhalaf, 2021). Examples of potential investment in public and private infrastructure that can support internal and international trade and economic development in the region include the construction of the Sinjar Trade Corridor, which targets the rehabilitation of the road from the Syrian border to the Dohuk governorate through Sinjar, providing a secure route and access to enable trade in goods and agricultural products, and that of a dry and reefer container bonded terminal (Olson & Speidel, 2024). Figure 3, the timeline map that illustrates the phases of agricultural recovery, such as infrastructure repair, return of farmers, equipment distribution, skill training, market access, and

production recovery. Each phase is displayed with its corresponding duration from 2017 to 2021, showcasing the progression of recovery efforts over time.

Figure 3, The Timeline of Agricultural Recovery Phases



Source: Authors' own elaboration based on International Fund for Agricultural Development (IFAD). (2019), World Bank. (2017), Olson & Speidel, (2024).

In addition to rehabilitating infrastructure and producing agricultural products, the Public Investment Project on fruit and olive tree planting in rural areas rehabilitated from the Islamic State also offers establishment and long-term benefits to returnees, by encouraging them and their subsistence agriculture to return, promoting tourism opportunities centered on the unique landscape typical of olive trees in the region and, in particular, providing a sense of security against future ISIS attacks. (Lo Bianco et al., 2021; Colombo et al., 2020)

3.2. Infrastructure Reconstruction

In conflict-affected areas, the physical infrastructure in the agricultural sector is often destroyed or heavily damaged. Reconstruction of the physical infrastructure in the sector is essential for providing the necessary conditions for the rehabilitation of its activities and outputs. Infrastructure traditionally includes irrigation systems, land improvement works,

protecting soil fertility, water harvesting, roads, veterinary care, and also local and national administrative services. It can be the responsibility of different government departments to repair and/or rebuild this infrastructure. The main purpose is to secure the basic needs for agricultural production. The requirements are to minimize the time lag from lifting the war waivers and abandonment to restart agricultural activities with its capabilities and potential for fodder production (Roach & Al-Saidi, 2021).

All collected information on physical damages of the agricultural infrastructure by terrorist actions gives planning hints to be used to define the quantity of materials and resources for rehabilitation work to re-enable agricultural activities. Buildings and agricultural infrastructure need to be rebuilt and re-supported during the re-insertion and economic rehabilitation of the farmers in the communities (Bourhrous et al., 2022). The reconstruction process will have to rebuild infrastructure such as houses, schools, mosques, animal stalls, and tool sheds destroyed by the ISIS conflict. Although the priority of governmental agencies is to provide the more basic services, they may fail to consider the needs of the agricultural sector. As such, it is essential for full efforts to be put into overcoming the physical damage caused by terrorist actions (Cordesman, 2022).

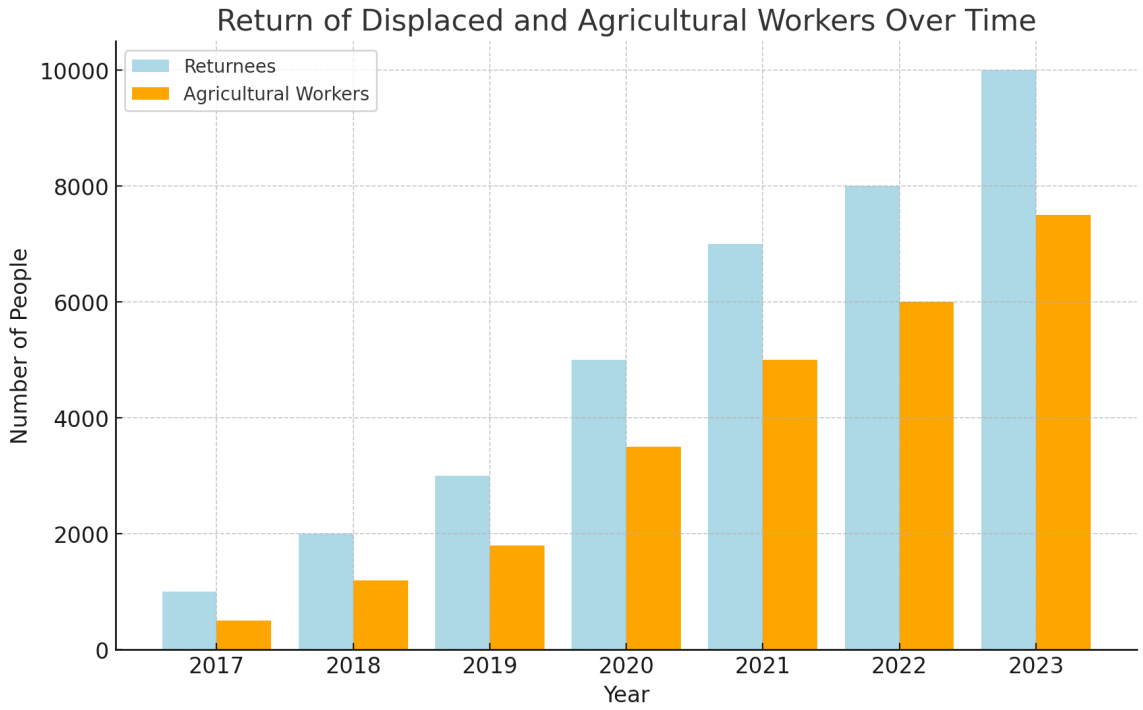
3.3. Capacity Building Programs

Capacity building programs for targeted beneficiaries are a complex process. However, one common denominator in such programs is the sequence in which the components are planned to reach the overall goal. The selection of the performers is vital and may have a significant influence on such programs (Al Aina & Atan, 2020; McKay et al., 2021).

When focusing on the rehabilitation of agricultural livelihood, the focus of such programs should be on partnerships with local governmental agencies and civil society organizations to plan and implement various types of capacity building activities. These organizations and agencies are likely to have a strong knowledge base of the design and implementation of such programs and will work more effectively on the establishment of effective and sustainable relationships with the targeted beneficiaries (Kövér, 2021).

Figure 4: Depicts the return of displaced individuals and the increase in agricultural workers over time, from 2017 to 2023, showing the positive impact of rehabilitation efforts.

Figure 4, Return of Displaced and Agricultural Workers over Time



Source: Authors' own elaboration based on International Organization for Migration (IOM). (2019), United Nations High Commissioner for Refugees (UNHCR). (2018), World Bank. (2020).

Two general categories of capacity building activities undertaken to strengthen the resilience of smallholder farmers are the human capital development and the organizational development, the other components of capacity building.

When focusing on the human capital development, a good example will be providing rural youth and young farmers with livelihood skills that would enable them to earn an income in agriculture and agribusiness activities. Training courses can be provided at agricultural vocational schools, colleges, and by extension services (Maïga et al., 2020). In addition, contests, led by support from the private sector or by the training centers, can serve as comprehensive events to disseminate knowledge and information, increase the practical skills of program beneficiaries, and offer awards and incentives. Such incentives should increase the skills of the targeted recipients, allow them to receive vouchers to purchase the inputs to boost the performance of their farming units, and to improve agricultural yields (Giagnocavo et al., 2022).

4.1. The Case of the Yazidis in Iraq

Before the ISIS crisis, agriculture was the predominant economic activity of the Yazidi community in the Sinjar district. They monocropped fields for wheat production and also

had vineyards, orchards, and vegetable gardens. Unfortunately, these economic structures were dismantled by ISIS, instigating a process of agricultural collapse. Thus, for the long-term and sustainable recovery of the Yazidi community, it is necessary to rebuild the economic structure and productive capacity of the district. Empowering the local inhabitants of the Sinjar district to produce their livelihood is also expected to result in attracting the internally displaced population and refugees back to their homes. Supporting the Yazidi farmers, alongside public infrastructure development, can act as a trigger for recovery on larger dimensions (Bourhrous et al., 2022).

Promoting entrepreneurship, creating permanent employment opportunities, and developing the infrastructure of the agriculture sector should be key priorities for restoring long-term economic dignity, viability, and resilience to newly liberated areas, such as the Sinjar district. This research will guide decision-making regarding a more meaningful return of internally displaced people to the Sinjar district. Its conclusions and policy recommendations will also be beneficial to development experts and societies involved in post-crisis reconstruction. In this paper, the agricultural infrastructure, dominant economic structure, and household properties in the Sinjar district are presented, followed by rehabilitation strategies. Finally, weaknesses and strengths, recommendations, and conclusions are discussed (Alkhalaf, 2021; Sadiddin et al., 2023).

4.2. Pre-Conflict Agricultural Practices

The Yazidi agricultural sector has a particular set of characteristics that demand a set of interventions distinctively relevant to their mode of agriculture. Many Yazidis are characterized as not only farmers, but traditional agriculturalists, especially with regard to growing wheat and barley. The Yazidi have largely subsistence production activities, which depend on the limited use of fertilizers and seed throughout the production process. A typical form of agricultural practice within most Yazidi locations is one of low-input, small-farm agriculture. The farming is very labor-intensive throughout the seasons of production, as no machinery is used in plowing, seeding, or reaping.

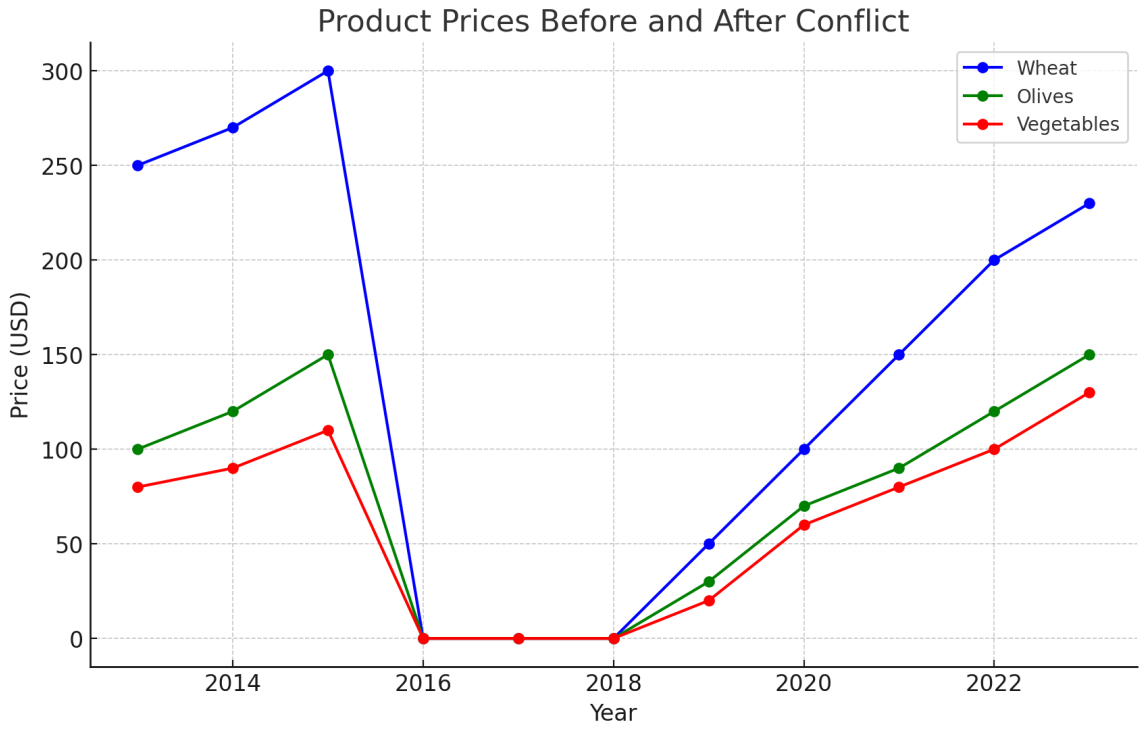
The production cycle starts with plowing. The plowing is done by the farmer and his family using animals, mostly cows or horses, attached to the plow. After that comes the process of leveling the land by simple tools. Following this, planting takes place. Wheat is central to the local agriculture, as it is vital for feeding both people and animals. It is central in

relation to the timing of the harvest. The labor is mostly done by female household members. After reaping, there are a number of other stages, including threshing, transporting the grain to be cleaned, and then dried. The seed is saved by the female household members. Any capital involved tends to be spent on items needed for the seasonal agricultural process, such as mostly animal feed and painkillers for the animals (Datt et al., 2021; Guevara-Arauza. 2021).

4.3. Post-Conflict Challenges and Opportunities

Lack of youth engagement in the production process in agriculture value chains has resulted in low interest in agricultural investment and development. The coming generation has abandoned its connection with the land and farm culture. Military conflicts have then accelerated this trend. In post-conflict transitions, rebuilding the agricultural sectors in affected areas and repositioning it as the main economic driver for farmers is a very complex challenge. The complexity of rebuilding both social and physical capital is due to the process of development of land, production, and social transformation (AFOLABI et al., 2022). Figure 5, presents the changes in product prices (wheat, olives, vegetables) before, during, and after the conflict, highlighting the severe drop in prices during the conflict and gradual recovery afterward.

Figure 5, the Product Prices befor and after the Conflict



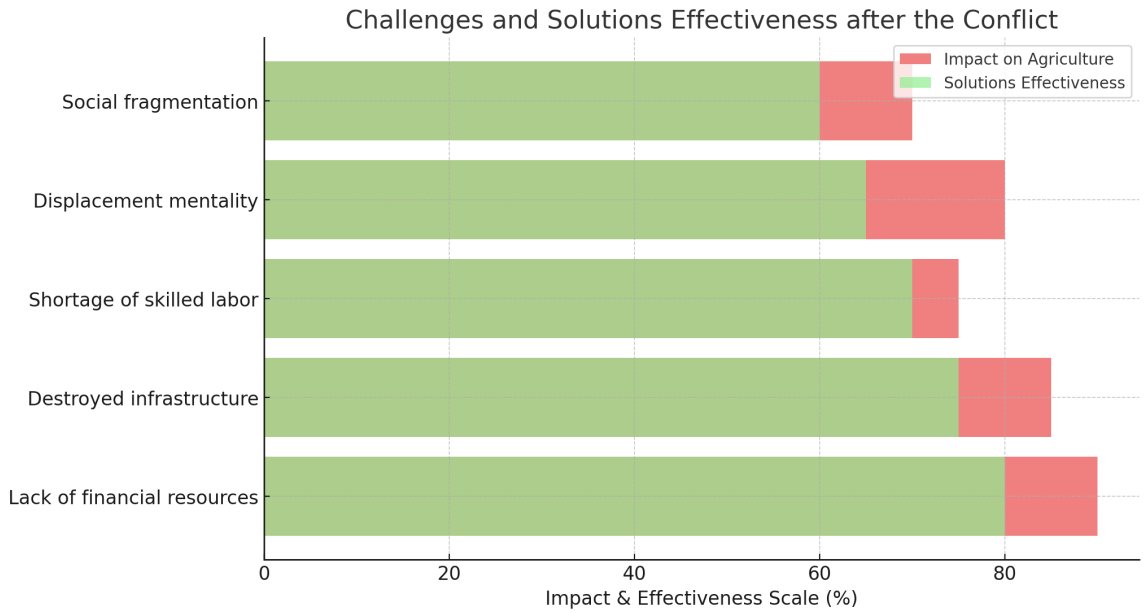
Source: Authors' own elaboration based on FAO. (2017), World Bank. (2018), Martin-Shields, C. P., & Stojetz, W. (2019).

During the ISIS crisis, as a direct result of being internally displaced, the Yazidi community has suffered significant mental health issues with an increase in depression and anxiety, especially among women who are searching for new agricultural activities that would suit their capabilities and help them resume their livelihood activities, both for their own healing effects as well as for the economic benefits (Ahmed & Heun, 2023; Rasheed et al., 2022).

The Yazidi costume and manual industry can be developed and adapted to the dress styles and agricultural tasks of Yazidi women that suit them and are therefore economically viable. The profitability of many agricultural activities of this community has declined due to instability, which has affected agricultural activities and caused significant price changes. In post-conflict areas, peace building can reposition the work of women and children and lead to the return of investments related to local agricultural products (Bourhrous et al., 2022; Khuder, 2023).

These problems depend on the conflict-initiating factor, war economy, "natural justice," gender, and marginalization of women, and the traditional approach that women's economic empowerment requires increased production. The traditional understanding of women's working class has changed, and these farmers have paid heavily for their declining participation, especially women (Yadav, 2021). Figure 6, challenges and solutions effectiveness after the conflict: A horizontal bar chart showing the severity of different post-conflict challenges (e.g., lack of resources, destroyed infrastructure) and the effectiveness of proposed solutions to address them.

Figure 6, the Challenges and Solution Effectiveness after the Conflict



Source: Authors' own elaboration based on World Bank (2018), Cramer, C., & Goodhand, J. (2002).

The goal of this research is to carry out specific interventions in six categories connected together and coupled in a matrix based on specific principles related to the psychological and social construction of themselves, the preservation of cultural goods, the process of rural development, and promotion of economic activities. The facility will allow marginalized people to obtain a necessary psychological, social, and economic boost by promoting Yazidi craft products and finally acting as visible sources of continuity and creation of investment opportunities (Duncan et al., 2020; Sandbank et al., 2020).

5. Conclusions and Recommendations

To ensure the success of agricultural sector rehabilitation efforts in conflict-affected areas, a comprehensive action plan should be implemented. This includes establishing agricultural training centers for affected communities, providing financial and technical support from international organizations, and setting up monitoring mechanisms to assess the effectiveness of rehabilitation programs over the coming years. These programs' success can be measured by tracking increases in agricultural production and improvements in food security (FAO, 2020). Following the principles of the sustainable livelihoods framework, a tailored agricultural training program commenced in a school in Bashiqa village in the Nineveh plains region in 2017, targeting conflict-affected male and female Yazidis in Iraq. We integrate mixed methods research, combining qualitative information collection and analysis methods (Bourhrous et al., 2022). The results suggest that this training program was able to improve confidence amongst Yazidis to rebuild their agricultural sector in the face of the loss of capabilities during the crisis and hardship suffered. Educational attainment increased capacity for proprietariness and livelihood assets which, in turn, can enhance capabilities, including entitlements to resources and acquisition of new skills and resources to perform livelihood functions (Bourhrous et al., 2022).

However, some short-term limitations in scheduling and coordination have emerged. Therefore, it is necessary for the Iraqi government and the community to come up with an inclusive plan for several years of trainings. Several years of trainings under certain conditions can make this community more resilient in the mid- to long-term, improving stabilization and development and on their way to autonomy and security in the region. In conclusion, we provide some general recommendations that are designed to improve interventions in crisis-affected areas, especially in agriculture. The proposed strategies include rebuilding agricultural infrastructure through public-private partnerships, with financial and technical support from international organizations such as the Food and Agriculture Organization (FAO) and the International Fund for Agricultural Development (IFAD). For example, establishing agricultural training centers that provide hands-on training to farmers on using modern agricultural technologies and sustainable resource management is essential. Furthermore, psychological and social support programs should

be provided to returning farmers to help rebuild their confidence and ability to resume agricultural livelihoods (Gellersen et al., 2021).

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3. Analysis of the impact of agriculture goods dumping in Iraq using ARDL methodology

Analysis of the Impact of Agriculture goods Dumping in Iraq using ARDL Methodology

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Abstract

The research highlights the need to develop effective protectionist economic policies to mitigate the negative effects of dumping, stimulate local production, and enhance food security. By addressing the dumping problem through policy interventions, Iraq can work to revive its agricultural sector, reduce dependence on imports, and promote sustainable economic growth.

This research aims to study the impact of dumping on the agricultural sector in Iraq, by analyzing the relationship between agricultural output and both agricultural goods imports and food imports for the period from 2000 to 2020. The Autoregressive Distributed Lag (ARDL) methodology was used to analyze annual data and determine the short- and long-term effects of imports on agricultural output.

The results showed a statistically significant long-term impact of food imports on agricultural goods, indicating that an increase in food imports is associated with an increase in agricultural goods. While agricultural imports did not show a statistically significant impact on agricultural goods. These results indicate that import dumping, especially in food products, contributed to the weakening of the ability of local agricultural producers to compete, leading to foreign monopoly in the market and a decline in local production.

1. Introduction

As a result of the ill-considered policies to liberalize the Iraqi market after 2003, the phenomenon of dumping worsened and became a major challenge to competition from foreign goods, especially agricultural goods and food (Daadoush and Al-Omari, 2022). The decline in domestic production due to the influx of cheap foreign goods led to a significant decrease in competitiveness, leading to a weakening of the overall economy due to the gradual replacement of local goods with foreign goods (Deardorff & Stern, 2005). The replacement of foreign goods with local ones had a negative impact not only on the agricultural sector but also included many sectors in the Iraqi economy (Kim & Roh, 2022).

The country's dependence on imported goods has caused paralysis in important sectors, a general weakness in production, and widespread unemployment. This is particularly worrying in light of the steady population growth, as Iraq's population increases by about 900,000 people per year (Blonigen & Prusa, 2016). To increase local production and revive and ensure economic stability, broad programs, and policies are required that include complete protection

of industry through regulating imports and working to set future goals that seek self-sufficiency and address dumping (Cheng et al., 2001). Increasing dependence on imported goods poses a risk to the economy the longer it lasts, as the country's dependence on cheaper foreign goods causes, in the first stage, the inability to compete, the closure of projects and the increase in unemployment. In the subsequent stages, the general economy weakens through low investment, slow growth, long-term inflation and high costs (M. Janabi, 2018). The importance of the study lies in diagnosing the harmful effects of dumping on the economy over the past twenty years. Dumping has led to weak competition, a decline in the quality of locally produced goods, and the closure of a large percentage of agricultural and industrial projects. In addition to material issues such as poor infrastructure, weak policies have exacerbated the problem (Mehdi et al., 2020; Prusa, 2001; Zanardi, 2004). This research aims to diagnose the negative effects of dumping that have affected the Iraqi economy in recent years, and to attempt to determine the necessary policies to treat this phenomenon.

This study uses quantitative and qualitative analysis methods, using data from 2000-2020. The data is analyzed to identify trends in dumping practices and how they affect the agricultural sector in Iraq. The data used were from official organizations concerned with agriculture, such as the Food and Agriculture Organization (FAO), statistics from the Iraqi Ministry of Planning, and reports from the Iraqi Ministry of Agriculture. This data provides a comprehensive picture of production, consumption, and imports, and it is also possible to identify the food gap and the size of the problem represented by the amount of imports from 2000 to 2020. The results of this study would enable researchers in the field of economics, specifically agricultural economics, to have empirical evidence of the impact of import dumping on agricultural production. Methodologically, this study is a contribution to the existing literature in the field of agricultural economics using the ARDL methodology to consider the relationship between import dumping and the production side. The study includes independent variables such as imports (as an indicator of dumping), local prices, and international prices, while the dependent variable is local agricultural production.

2. Literature Review

One of the biggest challenges facing developing countries is the phenomenon of dumping, perhaps due to the lack of effective policies or the weakness of management to design and get out of this predicament. The review of studies aims to understand the essential theses in this field that have taken the subject of dumping from different points of view. A study investigated

the adverse effects of market liberalization on industrial productivity in Iraq. In the role of economic policies followed in production, the study found that trade liberalization can enhance production if appropriately implemented; at the same time, protective measures are taken for the local product to prevent dumping. (Deardorff & Stern, 2005).

Studies by official institutions such as the World Bank and the Iraqi Ministry of Finance have confirmed the impact of agricultural policies on production and imports in Iraq after 2003. Effective policies lead to improved production, which enhances food security and addresses unemployment. In another note to the report, it also indicated that the deterioration of infrastructure is a major factor contributing to the poor performance of the agricultural sector and low production. Among the recommendations were the need for international support and concerted government efforts to overcome the challenges facing this sector (World Bank, 2008). As for the report of the Iraqi Ministry of Finance, it confirmed that economic policies affect the allocation of resources within Iraqi families. Good policies help to promote health and nutrition and reduce crime rates, which enhances social and economic benefits. (Ministry of Finance -Department of Economic Policies, 2012).

The impact of development on the economy as a whole and the potential benefits of improving the agricultural sector in Iraq have been the focus of many studies. One of these studies delved into increasing production, which could address poverty and improve living standards. In addition, the benefits of agriculture extend to other aspects, such as the environment, health, and other social dimensions (Boyden & Dercon, 2012). There is a noticeable impact in developing countries when implementing agricultural development programs and how they affect multiple aspects. The focus should be on policies that support the activation of this sector, such as technology, investments, and policies that support increasing production and reducing imports (Breisinger et al., 2012). The impacts of agricultural policies on economic growth and employment in Iraq have been thoroughly explored. Developing the agricultural sector can substantially improve income distribution and reduce poverty. Enhanced agricultural productivity not only increases agricultural income but also strengthens national food security, highlighting the crucial role of the agricultural sector in Iraq's economic development (Haboby et al., 2014).

Studies conducted by the Food and Agriculture Organization reviewed the status of the agricultural sector in that achieving agricultural objectives contributes significantly to diversifying sources of income and moving away from Iraq's dependence on oil as the sole

source of income. Agricultural development plans, according to the approach of the Iraqi Ministry of Planning, emphasized moving in this direction and activating the role of agricultural and then economic development (Republic of Iraq Ministry of Planning, 2013). Another study reviewed the status of Iraqi infrastructure and the security situation and their impact on production and development. The study recommended that improving infrastructure, improving the security situation and new policies would reduce the food gap and increase production (FAO, 2017). The study also found that introducing technology in agricultural inputs such as modern irrigation systems, improved seeds and other materials would increase production and push towards development (FAO, 2020).

Government support through agricultural guidance, loan facilities, and high-tech inputs contributes significantly to increasing production, a study conducted in 2021 found that support reduces dependence on imports (Mahmud, 2021). Reviewing previous studies helps provide a comprehensive view of the agricultural sector and understanding development and impacts on the quantity of imports and low production.

3. Evolution of Trade and Tariff Policies and the effects of production

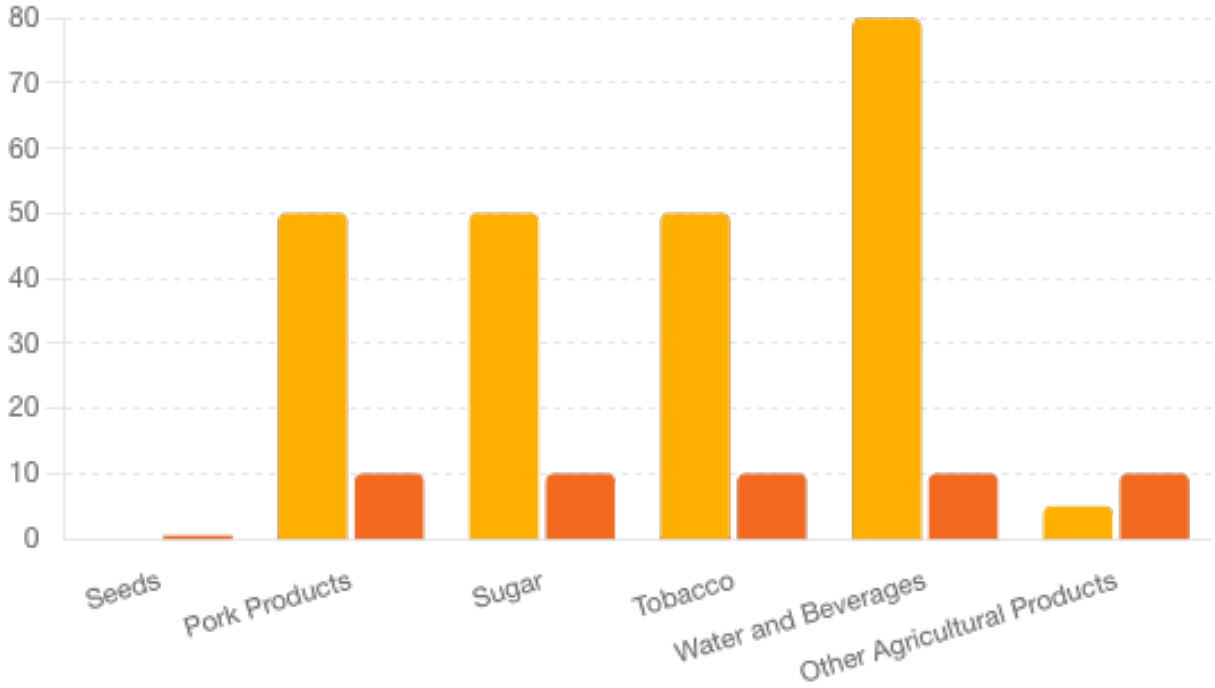
Right after the defeat of the Baathist regime, on June 7, 2003, L. Paul Bremer, the administrator of the Coalition Provisional Authority (CPA) (Halchin, 2005). Bremer promulgated the CPA Order No. 12/2003: "Recognizing the central role of international trade in Iraq's recovery and its development of a free-market economy. All tariffs, customs duties, import taxes, licensing fees and similar surcharges for goods entering or leaving Iraq, and all other trade restrictions that may apply to such goods, are suspended until December 31, 2003" (Talmon, 2013). On September 9, 2003, L. Paul Bremer promulgated the imposition of a "Reconstruction Levy" of 5% of the total customs value of goods entering Iraq (CPA Order No. 38). Finally, on February 24, 2004, the CPA declared in Order No. 54 the prolongation of the Order No. 12 of June 7, 2003: "All customs tariffs, duties, import taxes (not including the Reconstruction Levy imposed by CPA Order Number 38), and similar surcharges for goods entering or leaving Iraq are suspended until the sovereign transitional Iraqi administration imposes such charges following the CPA's transfer of full governance authority to that administration" (Talmon, 2013). Iraqi Transitional Government was set up in Mai 2005 and replaced by the first permanent government in 2006. However, it took further four years until Customs Tariff Law No. 22 of 2010 was enacted in order to replace the across-the-board 5% tariff rate labelled reconstruction levy with new tariffs. It was not another four years until the government started, in January

2014, the first phase of implementation of the new customs tariffs. Thus, from 2003 to 2014, the Reconstruction Levy of 5% was a fait accompli the only import duty for all goods entering Iraq, including agricultural products (Norsida, Radam, et al., 2017; A. Rahim & Ali, 2012).

According to the Customs Tariff Law No. 22 of 2010, agricultural import goods were subject to tariffs ranging from 0% for seeds to about 50% for poultry products, tobacco and sugar, also to 80% for water and drinks (FAO, 2020). In January 2018, these tariffs were amended by the Iraq General Commission of Customs (IGCC) according to Resolution No. 393/2017 of the Council of Ministers. Since then, there have been only four rates of customs duty (0.5%, 10%, ,%15 and 30%) for only 21 main important categories of the Harmonized Commodity Description and Coding System of the World Customs Organization. Agricultural products are overwhelmingly earmarked for 10% import duty (M. Janabi, 2018). Although these new tariffs are being applied at the customs, it is still not clear "as of December 2020" if they are permanent. According to §28 of the Iraqi constitution, only the Iraqi parliament is authorized to amend customs tariffs, whereas the above-mentioned resolution of the Council of Ministers was not submitted to the parliament for enactment. It is a common practice of the Council of Ministers to bypass the parliament and wait to see whether the courts will override the measure in question (Hameed, 2019). Figure 1 shows the comparison of tariff rates before and after 2018. Demonstrates notable reductions in tariff rates across different product categories after 2018. It showcases the effect of the new policy on agricultural production import tariffs in Iraq.

Figure 1: Comparison of Tariff Rates Before and After 2018

Y: Tariff Rate (%), X: Tariff Category, Yellow color Column is the Tariff Before 2018, Orang color Column is the Tariff After 2018.



Source: Authors' own elaboration based on Hameed (2019).

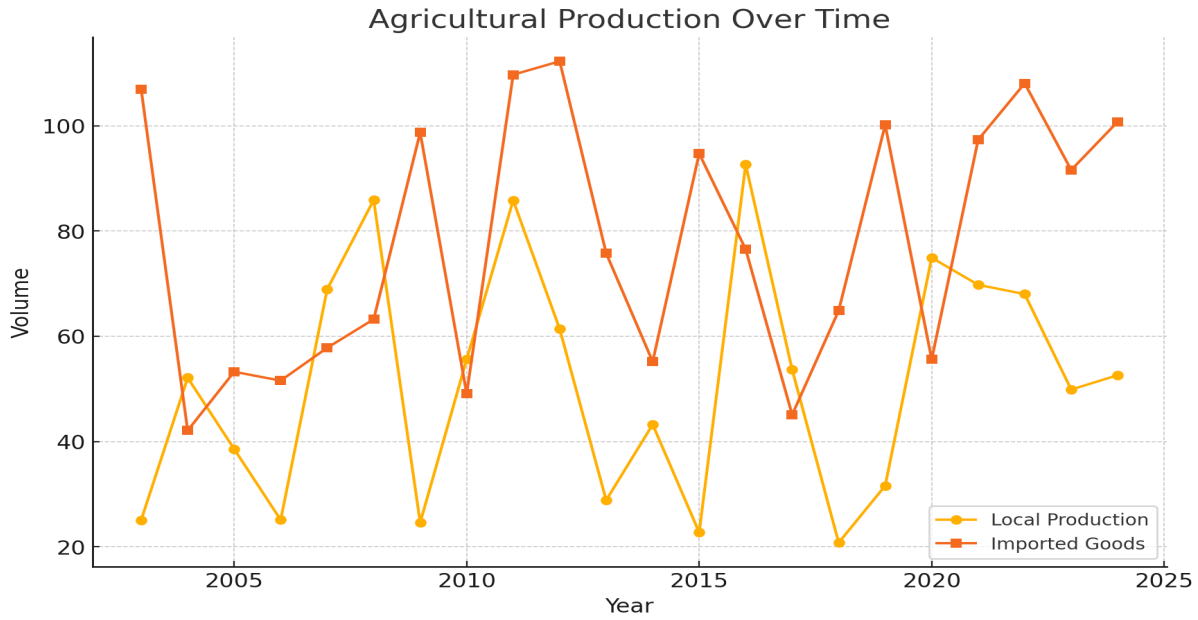
Concerning the rather moderate increase in import tariffs since 2014, it is not realistic to expect that they will create effective protection for Iraqi farmers against agricultural imports from Iran, Jordan, and Turkey as the main regional exporters. It should also be noted that a considerable amount of agricultural imports of Iraq are not subject to customs controls due to widespread smuggling and corrupt practices of the customs administrations. The National Development Plan 2018-2022 listed under the heading "Agricultural development challenges" at the third place: "Poor control and monitoring of border outlets that led to increased illegal competition of imported agricultural crops and products with local ones" (Republic of Iraq Ministry of Planning, 2018). The increasing real exchange rate[1] of the IQD to USD, and the latent devaluation of the Iranian Rial and Turkish lira, create a permanent source of ruinous competition from these neighboring countries (M. Khaled, 2014).

This currency effect is augmented by dumping practices of exporters from neighboring countries. This has led to the deepening of the principle of market access, trade liberalization, and the reduction of trade barriers, especially those imposed by international agreements and laws (Dadoosh & Alomary, 2022). Consequently, a phenomenon called market dumping has emerged, which involves dumping foreign goods into the market with the goal of achieving

[1] In 2004, the CPA issued a new IQD at an initial parity of 4,000 to USD. The currency appreciated until 2012 to parity of around IQD 1,170 to USD and displayed no notable change since then (as of December 2020).

profits, dominating certain markets, and overcoming competitors in the long term (Zhou & Percival, 2016). This often results in significant damage to local production, making the policy of dumping a harmful practice that must be combated due to the losses it inflicts on local producers and the real threat it poses to domestic production (Showkat, 2024). As evidenced in Figure 2.

Figure 2: Agricultural Production Over Time



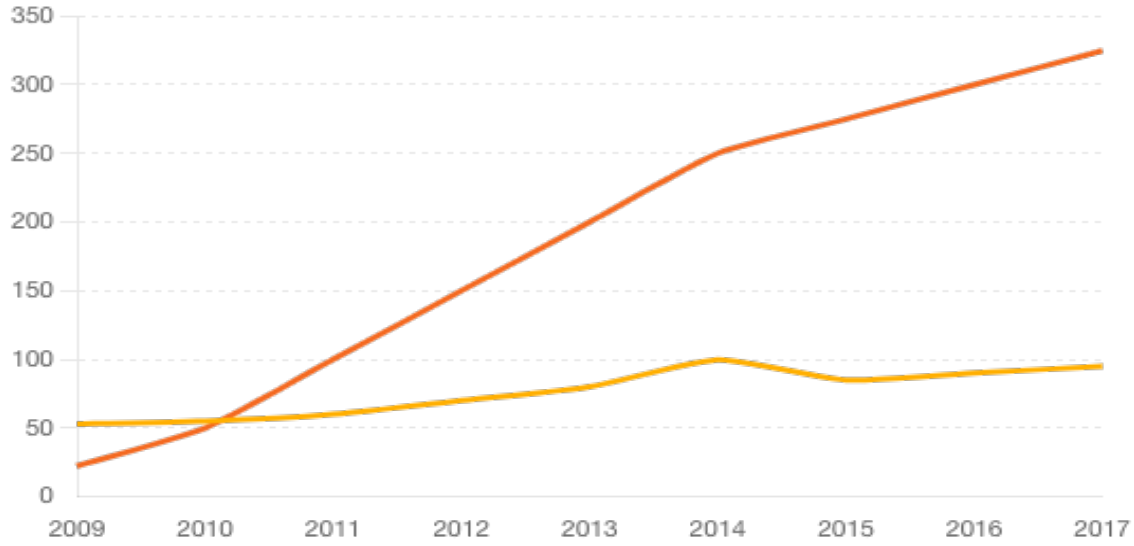
Source: Authors' own elaboration based on FAO, (2017 und 2020), M. Janabi (2018), Ministry of Agriculture, (2024).

The cases of chicken, egg, and eggplant imports from Jordan and Turkey (Ghadhban & O. K. Jbara, 2019). The production of chicken in Iraq fluctuated between 53.0 (2010) and 99.6 thousand tons (2014) between 2009 and 2017, whereas chicken imports increased in the same

period rather steadily in 2009 from 22.4 thousand tons to 324.8 thousand tons.in 2017 (Ghadhban & O. K. Jbara, 2019). Also, in the cases of egg and eggplant imports, there was a considerable dependency ratio, though not with an increase comparable to chicken imports. The authors calculated dumping margins for chicken imports from Turkey showing that these margins were more than 16% (2011) throughout the period, with more than 100% in seven of those years. In the case of egg imports from Turkey, the minimum dumping margin was 9% in 2011 with more than 100% in five of those years. Eggplant imports from Turkey displayed the highest dumping margins, with a minimum of 37% (2017) and a maximum of 813% (2009). The import of those products from Jordan in the same period displayed permanent and high dumping ratios, although less gloomy than in the case of Turkey (Ghadhban & O. K. Jbara, 2019). As shown in Figure 3 the import and the production of chicken. The trends in chicken production and imports in Iraq from 2009 to 2017. It shows a significant increase in chicken imports compared to the relatively stable and moderate increase in domestic chicken production.

Figure 3: Chicken Production and Imports in Iraq (2009-2017)

Y: Thousand Tons, X: Years, Yellow color curve is Chicken Production, Orang color curve Chicken import.



Source: Authors' own elaboration based on Ghadhban & Jbara, (2019).

Minimum price support (MPS), import controls and input subsidies are the main instruments of agricultural market regulation ever since the 1950s in Iraq. Prior to 2003, they were integrated into an elaborate system of semi-socialist state agencies that also provided agriculturalists with access to land, credit, inputs, irrigation infrastructure, and cooperative

administrations. Since the dismantling of this system, the expectation that removing the state would permit the market and enable private agents to fulfill these functions more efficiently did not happen. Given the destruction of the economy in 2003, the withdrawal of the state was tentative at best resulting in a hybrid system of agricultural markets. On the one side, the old regime of heavy government intervention in markets continued. “In Iraq, the state is involved in every single step of the food value chain. From pre-seeding to placing food on each Iraqi’s table, the Iraqi state has impelled government dependency across its population through continuous state intervention and involvement” (Fathallah, 2020). On the other side an open market for agricultural imports was established. What is more, this mishmash of policies is managed by a highly ineffective public administration lacking transparency and accountability, creating a serious constraint to the development of competitive and efficient agricultural markets (World Bank, 2019).

The beginning of the MPS date back to 1972 when Law No. 50 was enacted, leading to the cessation of the private sector's roles in grain trade and the government becoming the sole buyer of grains in Iraq in 1973. In 1979, the General Organization for Agricultural Marketing (GOAM) was established to expand government control to other food markets, such as vegetables, meat, and fruits, by establishing state wholesale markets, storage, and packaging facilities. After 1987, control of vegetable and fruit markets was abolished, and some of the GOAM activities were transferred to the private sector. After a short interruption in 2003, the GBI resumed its quasi-monopoly of grain trade in Iraq by means of MPS for main grains, namely wheat, barley, rice, and corn, which are also components of the Agricultural Distribution System (ADS). Until 2018, even the import of the most strategic grain, namely of wheat, was in the monopoly of the GBI, enabling the state to total market control. Since 2018, private companies are allowed to import some grains, especially wheat, and to process them in private mills and factories. The overwhelming role of the government as a purchaser from the agrarians, importers, processors, and distributor of grains to the consumers is the main factor for market rigidities hindering the emergence of a competitive market and a serious constraint for private investment in this subsector (Ibrahim & Abdullah, 2022).

3.1. The Concept of Dumping

Dumping is the business practice of exporting a product in an importing country at a value lesser than the local market value in the exporting country. In essence, it occurs when a country

exports a product at a price value lower than its normal value. This standard value can be described as either less than the local selling price, or less than the production costs of the product in the exporting country (WTO, 2023). Another definition of dumping is exporting a product at a price that lowers its production costs in export markets through the loss compensated by selling at a higher price in the domestic market (Zhou & Percival, 2016). Dumping practices harm countries' economies as they represent unfair economic and trade competition which harms local makers in the importing country (Kostecki, 1991). Consequently, countries must address dumping to protect their domestic production (Davis, 2009).

Dumping is a harmful practice that can occur for two main reasons. First, it can occur when a producer wants to dispose of a large amount of product or crop as quickly as possible, selling it at the lowest possible price (Schmidt, 2023). Second, it may be driven by strategic objectives, such as market control or eliminating competition (Araujo et al., 2001). As explained in Figure 4. Therefore, it is essential for nations to monitor and act against dumping practices in order to safeguard their domestic industries.(Ding et al., 2023).

Figure 4: The distinction between competition and dumping is based on the methods utilized and the level of economic efficiency attained

Competition	Dumping
Competition happens when producers compete with each other to enhance product quality and reduce costs using modern production methods. The goal of competition is to dominate the market while achieving the efficiency of economics through lower production charges and improved the quality of the product. Prices are single-minded based on the laws of demand and supply, and fair competition is promoted.	When producers sell their products at prices less than their production costs, it is known as dumping. The primary objective of dumping is to eliminate competition by forcing other local producers out of the market. This practice aims to dominate the market without achieving economic efficiency, often resulting in the dominance of the exporting product in the local market of the importing country.

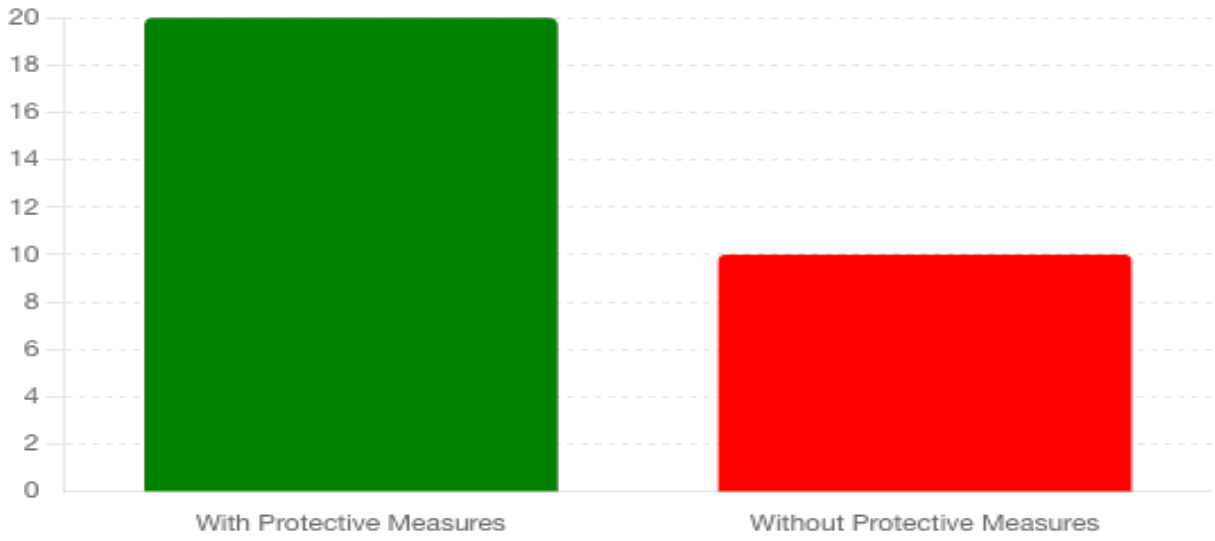
Source: Authors' own elaboration based on Araujo et al., (2001), Dadoosh & Alomary, (2022), Viner, (1923), Zhou & Qu, (2022).

In the case of market control, an exporter may aim to dominate a country's domestic market by selling products at low prices, which can lead to long-term economic gains (WTO, 2023). On the other hand, dumping can be used to eliminate competing producers, especially those in the importing country. Selling products at extremely low prices, competing producers are unable to sustain themselves in the local market (Smith, 2022). Once the exporter has established dominance in the local market importing country, they can increase prices and achieve substantial profits (Kostecki, 1991). Dumping practices can have serious negative consequences for the economies of importing countries, particularly for local producers.

The World Trade Organization (WTO), was established in 1995, plays a fundamental role in regulating international trade. Its primary mission is to simplify the smooth flow of international services and goods by reducing trade restrictions and discipline in international trade and establishing rules of conduct. The WTO aims to ensure fair competition and non-discrimination among its member countries, thereby granting equal entrance to each other's marketplaces. This objective is critical in promoting a balanced and equitable global trading system (B. M. Hoekman & Kostecki, 2009).

The WTO also emphasizes the temporary nature of anti-dumping measures, which are typically reviewed and can be suspended after five years unless further investigation justifies their continuation. This provision ensures that measures are not maintained longer than necessary and that they remain consistent with the principles of free and fair trade (WTO, 1995).
Moreover, studies have shown that the economic impact of antidumping measures can vary widely. Antidumping duties can lead to significant market distortions if not carefully managed. Therefore, ongoing monitoring and evaluation are essential to ensure that these measures achieve their intended protective effects without unduly hindering trade (Prusa, 2001). Figure 5 shows the effects of liberalization on trade on industrial productivity in Iraq.
The impact of trade policies on industrial productivity with and without protective measures, showing a significant enhancement in productivity with the implementation of protective measures.

Figure 5: Impact of Trade Policies on Industrial Productivity



Source: Authors' own elaboration based on Deardorff & Sterm, (2005).

The WTO plays a vital role in international trade, regulating and protecting member countries from unfair competition practices like dumping. By providing a legal framework and guidelines for anti-dumping measures, the WTO helps ensure a fair-trading environment that supports the growth and development of domestic industries. However, the effectiveness of these measures varies among countries, highlighting the need for continuous capacity building and international cooperation to uphold the principles of fair trade (Viner, 1923).

Anti-dumping applications: International trade policies play a substantial role in economic policymaking, both at the countrywide and global levels. These policies impact the economic development programs of countries and determine their position in the global market and the international arena.

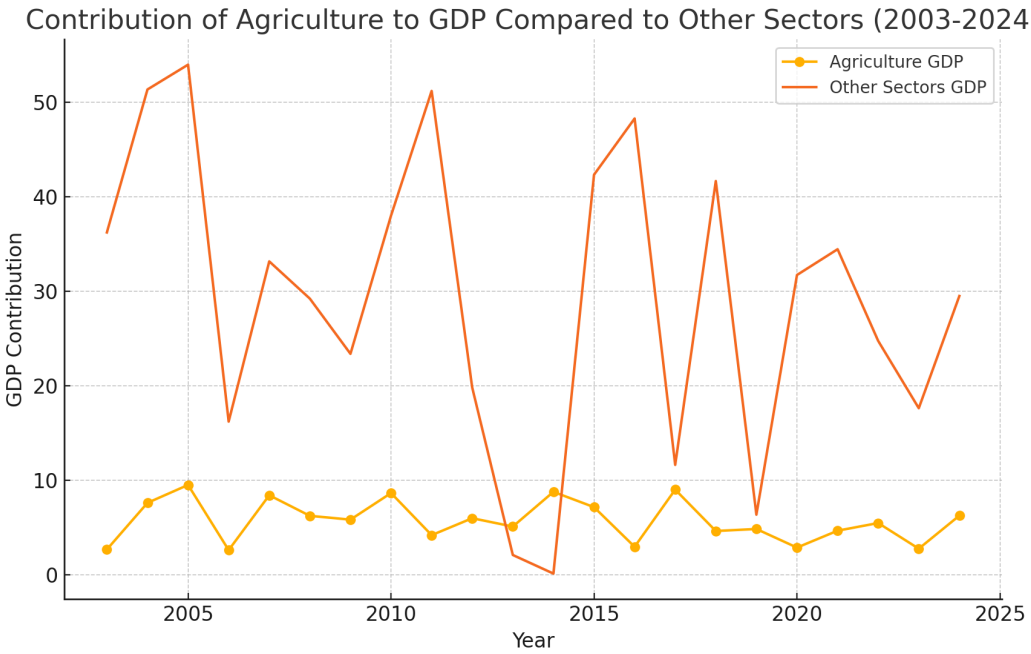
Expanding international trade is essential for enhancing specialization and the division of labor across the world. However, some countries limit the freedom of international trade and impose barriers to international exchange, especially concerning imports, even though free trade can benefit all parties involved. Trade policies differ based on the economic system, its level of development, the international political and economic context, and the nature of prevailing international economic relations (Anderson & Yao, 2003; Moore & Zanardi, 2017; Ossa, 2018). Economic impacts of agricultural protection demonstrate significant differences between the United States and Japan, indicating how varied trade policies can affect economic outcomes.

The concept of international trade policy has numerous definitions, yet they converge on the same objective. Some define trade policy as "the set of means used by a state in its trade within its external relations, with the aim of achieving specific national goals" (Blonigen & Prusa, 2003). These goals depend very much on the level of development. In advanced countries, the purpose may be to achieve full employment as proposed by Keynesian analysis, while in developing countries, trade policy is often used to serve economic development (B. Hoekman & Kostecki, 2009).

After 2003, Iraq moved suddenly to a free trade system under law No. 54, which was issued by the civil governor, P. Bremer, in 2004. This law eliminated discrimination in foreign or imported goods and introduced immediate commercial freedom. Consequently, the market in was flooded with crops, as well as plants, various agricultural, and animal products.

However, at the same time, Iraq's domestic agricultural production suffered due to the lack of knowledge and resources additionally, agricultural lands and facilities were destroyed during military operations. This resulted in a significant decrease in agricultural output, both crops and livestock, in Iraq. As a result of the adoption of the commercial freedom policy and openness, the relative significance of domestic agricultural products in Iraq decreased, leading to a decline in its contribution to Iraq's GDP from 2003 to 2024. Figure 6 illustrates the contribution of agriculture to GDP in the last period.

Figure 6: Contribution of Agriculture to GDP Compared to Other Sectors (2003-2024)



Source: Authors' own elaboration based on FAO, (2020), Ministry of Agriculture (2024).

Anti-dumping measures are trade defense instruments that protect national industries from exporters' competition perceived as unfairly priced imports (Bown, 2009). The imposition of anti-dumping duties is justified when it can be proven that imports are being sold at less than their usual value, causing significant harm to domestic production (Prusa, 2001). The lack of anti-dumping policies in Iraq has led to a market inundated with cheaper foreign goods, making it difficult for local producers to compete (Evenett, 2019; Staiger & Sykes, 2017).

4. Results and Analysis

Analysis Using the Autoregressive Distributed Lagging (ARDL) Methodology
In studying the relationship between agricultural output and both agricultural and food imports in Iraq

Standard study methodology:
Data source: Iraqi Ministry of Planning, Central Statistical Organization, Foreign Trade Statistical Bulletin, Arab Organization for Agricultural Development, Arab Agricultural Statistics Yearbook, National Accounts Directorate.

Statistical program used: EViwes 12

First - Building the model:

- Formulating the model (mathematical form of the model):

- Model tests:

a. Time series stability test:

b. Joint integration test:

c. Diagnostic tests for the (ARDL) model.

d. Structural stability test for the coefficients of the (ARDL) model.

e. Estimating the relationship in the short and long term using the Error Correction Model (ECM).

First - Building the model: The Autoregressive Distributed Model Lag (ARDL) was estimated in the study of the relationship between agricultural output as a dependent variable and both agricultural imports and food imports as independent variables to show the effect of each on the dependent variable, as 21 annual observations of the variables were monitored from 2000 to 2020. This model is distinguished by testing the linear relationship between the studied variables, in addition to the fact that it does not allow the presence of second-degree integrated variables I (2) as it determines the joint integration relationship, i.e. the equilibrium relationship between the dependent and independent variables and determines the size of the effect of each independent variable on the dependent variable. It also determines the relationship in the short term by estimating the error correction model that contains the error correction limit and measures the model's ability to return to equilibrium after any shock occurs in the model. The ARDL model also eliminates the problem of autocorrelation in the residuals, and is used in the case of small-sized samples. The distributed lag autoregressive methodology was presented by (Pesaran; 2001) and (Shin; 1995) as a mixture of regression models with distributed lag models and is defined as a regression model that contains the lagged values of the dependent variable and the current and lagged values of the independent variables for one or more periods. If there is a dependent variable (Y) and more than one independent variable (Xi), the general mathematical formula for the (ARDL) model is as follows:

$$y_t = \alpha + \sum_{i=1}^{p} \lambda_i \, y_{t-i} + \sum_{j=1}^{k} \sum_{i=1}^{q} \beta_{ij} x_{j,t-i} + u_t$$

Where:

(P) Number of lag periods for the dependent variable.

(q) Number of lag periods for the independent variable.

(K) Number of independent variables.

(Ut) Random error vector.

Stages of estimating the required model:

1. Writing the general formula of the model:

From the above, the model (mathematical form of the model) can be formulated according to the following formula:

AP = C (1) *AP (-1) + C (2) *AP (-2) + C (3) *IF + C (4) *IF (-1) + C (5) *IF (-2) + C (6) *IF (-3) + C (7) *IF (-4) + C (8) *IM + C (9) *IM (-1) + C (10) *IM (-2) + C (11) * IM (-3) + C (12) *IM (-4) + C (13).

2. Testing the stationarity of time series variables according to the (Phillips-Perron) test: Time series data are constantly changing as a result of developments and growth over time, and therefore they are characterized by instability of the mean and variance, and it is necessary to verify the extent of their stability by using the stationarity test (unit root test), and determining their degree of integration, before using them in standard analysis to avoid obtaining misleading or inaccurate results that may change the reading of the actual reality of the relationship studied between the variables. Despite the multiplicity of stationarity tests; The (PP) test is considered the best in knowing the state of stationarity of short time series used in the regression model with multiple gaps (ARDL).

Figure 7: Unit root test results

UNIT ROOT TEST RESULTS TABLE (PP)			
Null Hypothesis: the variable has a unit root			
At			
Level			
	AP	IF	IM

With Constant	t-Statistic	-1.6620	-2.8129	-3.4656
	Prob.	***0.4342***	***0.0743***	***0.0205***
		n0	*	**
With Constant & Trend	t-Statistic	-1.5946	-2.5858	-3.2903
	Prob.	***0.7585***	***0.2892***	***0.0964***
		n0	n0	*
Without Constant & Trend	t-Statistic	-0.0155	-1.4179	-1.4100
	Prob.	***0.6656***	***0.1409***	***0.1429***
		n0	n0	n0
	At First Difference			
		d(AP)	d(IF)	d(IM)
With Constant	t-Statistic	-3.6448	-5.7183	-10.1860
	Prob.	***0.0147***	***0.0002***	***0.0000***
		**	***	***
With Constant & Trend	t-Statistic	-3.5357	-5.9085	-17.2068
	Prob.	***0.0640***	***0.0007***	***0.0001***
		*	***	***
Without Constant & Trend	t-Statistic	-3.6645	-5.8410	-10.3425
	Prob.	***0.0010***	***0.0000***	***0.0001***
		***	***	***

Notes:

a: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

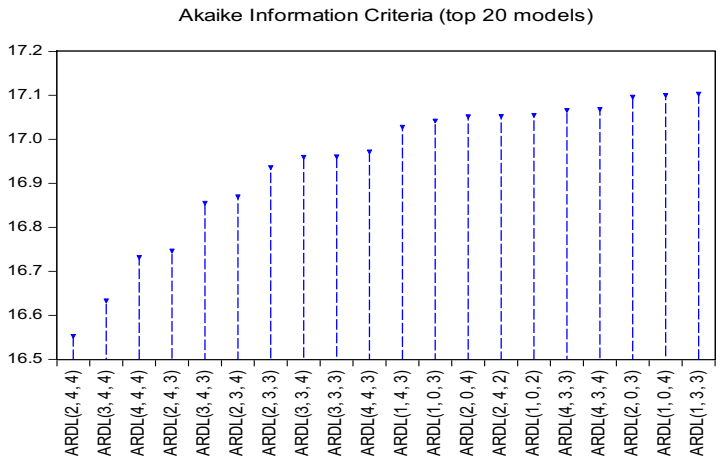
c: Probability based on MacKinnon (1996) one-sided p-values.

Source: Prepared by the researcher based on the outputs of the EViews program.

The test results at a significance level of 5% show that all the studied variables are not stable at the level whether there is a constant or a vector or without them, while they are all stable at the first difference with the constant as well as with a vector without the constant, and while both the agricultural and food import series are stable at the first difference with the vector and the constant, the output series is not stable and therefore there are no integrated variables at the second degree I (2) and this is one of the most important conditions for using the (ARDL) model.

3. Testing the determination of the optimal lag periods for the model: The optimal lag periods for the model were determined according to the Akaiket criterion and using the maximum number of gaps (4) and the Schwarz information criterion (SIC). The best model was according to the lowest value shown by the test results as representing (2,4,4), i.e. among all the models that can be estimated according to multiple lag periods, this model is the best to represent the relationship studied, as the dependent variable (AP) is slowed by two periods, and each of the independent variables (IM) and (IF) is slowed by four periods.

Figure 8: Unit root test results: Akaike test results for determining lag periods



Source: Prepared by the researcher based on the outputs of the EViews program.

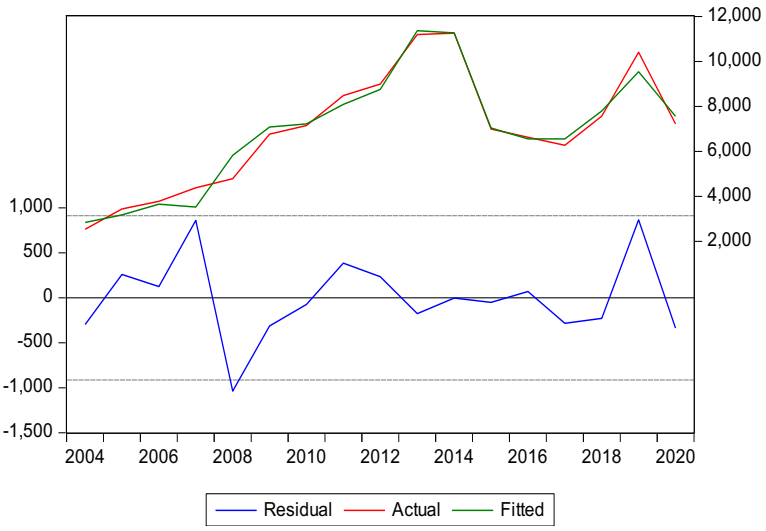
Diagnostic tests of the model:

Before adopting model (2,4,4) in estimating the short- and long-term relationship and its effects, the quality of this model's performance must be verified by conducting the following tests:

A. Test comparing the actual and estimated values:

The results of this test, represented in the following figure, show that the estimated values are close to the actual values, which indicates the quality of the estimated model.

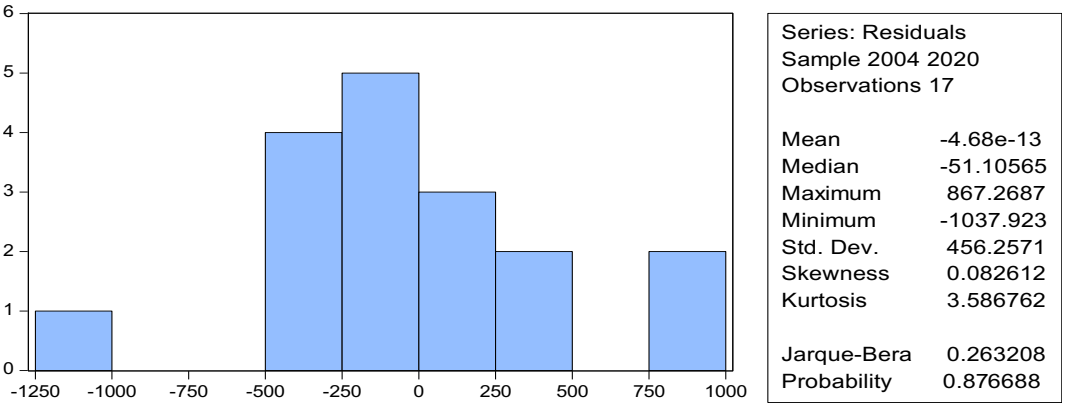
Figure 9: Results of testing the estimated and actual values of the model



Source: Prepared by the researcher based on the outputs of the EViews program.

B. Normal distribution of residuals: The nature of the distribution of residuals is verified by testing the hypothesis that "the residuals are normally distributed." This is done by extrapolating the statement that allows observing the accumulation of residuals around the center and decreasing as they move away from the center toward the outskirts, or not.

Figure 9: Results of the Jarque-Bera test for normal distribution



Source: Prepared by the researcher based on the outputs of the EViews program.

The results show by comparing the values of (Jarque-Bera) and as is clear from the previous figure that the residuals are subject to normal distribution.

C. Autocorrelation test for errors: The presence of autocorrelation of the residuals is verified through the Lagrange statistic calculated according to the (LM) test, and the results show that there is no autocorrelation between the values of the residuals of the model.

Figure 10: Breusch-Godfrey test results

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.320887	Prob. F(2,2)	0.7571
Obs*R-squared	4.129862	Prob. Chi-Square(2)	0.1268

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 09/26/24 Time: 11:17
Sample: 2004 2020
Included observations: 17
Presample missing value lagged residuals set to zero.

Source: prepared by the researcher based on the outputs of the EViews program.

D. Homogeneity of variance test: This test is conducted according to (Breusch-Pagan-Godfrey), and its results show that its probability value is greater than the significance level, and therefore the statement is homogeneous or constant.

Figure 10: Homogeneity test results

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.836379	Prob. F(12,4)	0.6379

		Prob.	Chi-
Obs*R-squared	12.15551	Square(12)	0.4333
Scaled explained SS	0.870405	Prob. Square(12)	Chi- 1.0000

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 09/26/24 Time: 12:00

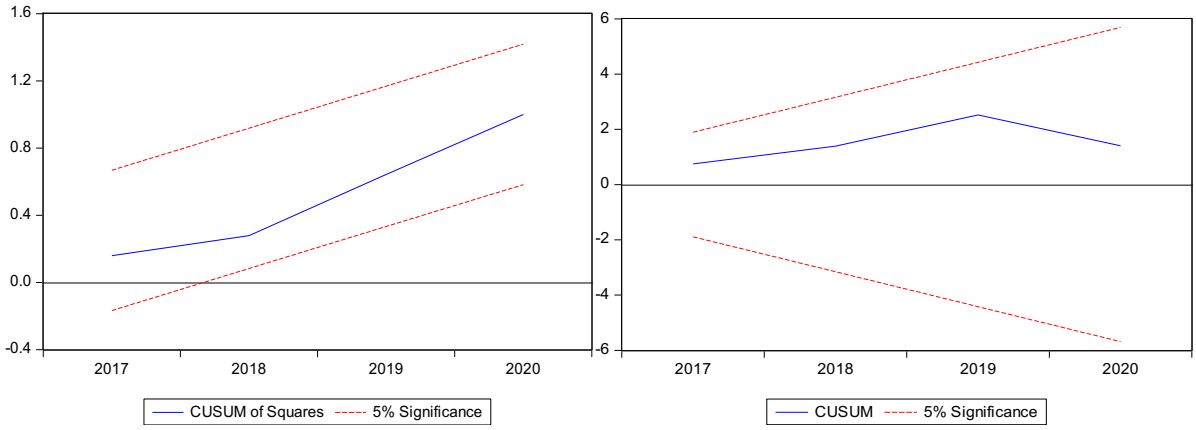
Sample: 2004 2020

Included observations: 17

Source: Prepared by the researcher based on the outputs of the EViews program.

E. Residuals stability test: This test is used to verify that the data is free of any structural changes and that the model is valid for prediction, by judging the stability of the model through the graphical form of the movement of the model residuals as well as the squares of the model residuals as shown in the following figure, which shows its graphical representation within the critical limits at the significance level, which means accepting the stability of the model:

Figure 10: Results of the residual stability test



Source: Prepared by the researcher based on the outputs of the EViews program.

4. Testing the model parameters in the short and long term: Through this test, the possibility of joint integration between the model variables is studied, and the impact of the independent variables on the dependent variable is evaluated, in the long and short term.

A. Joint integration according to the bounds approach:

This test verifies the possibility of joint integration between the model variables using the bounds test methodology, the results of which indicate, given the probability values that are greater than the significance level, that there is no joint integration relationship between the studied variables. This means that there is a long-term equilibrium relationship between agricultural output and both agricultural imports and food imports.

Figure 11: Results of the Bound test for joint integration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asym: n=1000	
F-statistic	1.670459	10 Percent	2.63.	3.35.
k	2	5 Percent	3.1.	3.87.
		2.5 Percent	3.55.	4.38.
		1 Percent	4.13.	5.
			Finite Sample: n=35	
Actual Sample Size	17			
		10 Percent	2.845.	3.623.
		5 Percent	3.478.	4.335.
		1 Percent	4.948.	6.028
			Finite Sample: n=30	
		10 Percent	2.915	3.695
		5 Percent	3.538	4.428
		1 Percent	5.155	6.265

Source: Prepared by the researcher based on the outputs of the EViews program.

Long-term relationship: The results of the long-term relationship test between the dependent variable and the independent variables show that there is a statistically significant long-term effect of the food imports variable on agricultural output, while there is no statistically significant effect of the agricultural imports variable on agricultural output.

Figure 12: Results of testing the long-term relationship between variables

ARDL Long Run Form and Bounds Test

Dependent Variable: D(AP)

Selected Model: ARDL(2, 4, 4)

Case 2: Restricted Constant and No Trend

Date: 09/26/24 Time: 14:09

Sample: 2000 2020

Included observations: 17

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IF	3.104429	1.100514	2.820889	0.0478
IM	0.323882	0.439902	0.736259	0.5024
C	-879.2130	2661.215	-0.330380	0.7577

EC = AP - (3.1044*IF + 0.3239*IM -879.2130)

Source: Prepared by the researcher based on the outputs of the EViews program.

Short-run relationship analysis: The error correction model (ECM) is used in the short-run relationship analysis in the ARDL model, where the error correction term is added as an explanatory variable, as it measures the amount of short-run imbalance that is corrected to return to the long-run equilibrium state as follows:

Figure 13: Results of the short-term relationship test between variables

ARDL Error Correction Regression

Dependent Variable: D(AP)

Selected Model: ARDL(2, 4, 4)

Case 2: Restricted Constant and No Trend

Date: 09/26/24 Time: 14:03

Sample: 2000 2020

Included observations: 17

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AP(-1))	-0.372337	0.127906	-2.911022	0.0436
D(IF)	2.696513	0.489585	5.507755	0.0053
D(IF(-1))	0.300805	0.176370	1.705528	0.1633
D(IF(-2))	0.087946	0.173771	0.506103	0.6394
D(IF(-3))	-0.478397	0.180146	-2.655603	0.0566
D(IM)	-0.012243	0.080722	-0.151664	0.8868
D(IM(-1))	-0.215171	0.143720	-1.497152	0.2087
D(IM(-2))	0.058567	0.152478	0.384099	0.7205
D(IM(-3))	0.213980	0.102312	2.091442	0.1047
CointEq(-1)*	-0.652711	0.190877	-3.419534	0.0268

R-squared	0.932715	Mean dependent var	307.0618
Adjusted R-squared	0.846207	S.D. dependent var	1758.943
S.E. of regression	689.7959	Akaike info criterion	16.19984
Sum squared resid	3330728.	Schwarz criterion	16.68996
Log likelihood	-127.6986	Hannan-Quinn criter.	16.24856
Durbin-Watson stat	2.483789		

* p-value incompatible with t-Bounds distribution.

Source: Prepared by the researcher based on the outputs of the EViews program.

The results of the error correction model in studying the relationship between agricultural output and agricultural and food imports, shown in the following table, show that:

- There is a positive and statistically significant effect of the food imports variable and the one-period lagging on agricultural output, where whenever agricultural imports increase by 1%, agricultural output increases by 2.697%.
- There is no statistically significant effect of the agricultural imports variable on agricultural output.
- There is a short-term dynamic relationship between agricultural output and food and agricultural imports, due to the negative and statistically significant estimated error (-0.652711), which measures the percentage of imbalance in the dependent variable that can be corrected from one time period to another, in other words, 62% of the changes in agricultural output are attributed to structural changes in the independent variables.

5-Discussion

International trade policies play a significant role in economic policymaking, both at the national and global levels (Zanardi, 2004). These policies impact the economic development programs of countries and determine their position in the global market and the international arena (Krugman et al., 2018).

Expanding international trade is essential for enhancing specialization and the division of labor across the world. However, some countries limit the freedom of international trade and impose barriers to international exchange, especially concerning imports, even though free trade can benefit all parties involved (Bhagwati, 2004). Trade policies differ based on the economic system, its level of development, the international political and economic context, and the nature of prevailing international economic relations. There are two main approaches in economic thought and practice:

Figure 14: Analysis of the Impact of Trade Dumping on the Iraqi Economy

Impact	Details	Recommendations
Impact on Local Production	Significant decline in local production due to inability to compete with cheaper	Implement protective tariffs on dumped products and provide financial and

	foreign imports, leading to lower quality of local products.	technical support to local producers.
Impact on Employment	Increased unemployment rates as many local factories and farms shut down, particularly affecting the youth.	Create job opportunities by supporting local industries and investing in skill development programs for the youth.
Impact on Inflation	Initial decrease in prices followed by long-term inflation due to reliance on imported goods, leading to higher living costs.	Stabilize prices by reducing dependence on imports and investing in local production capabilities.
Impact on Economic Growth	Slowdown in economic growth due to reduced investments in local industries and weakened infrastructure.	Boost economic growth by diversifying the economy, improving infrastructure, and attracting both local and foreign investments.

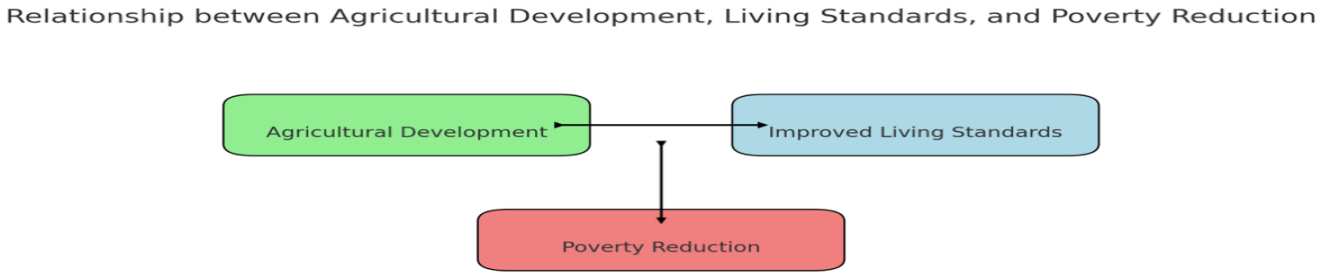
Source: Authors' own elaboration based on Mahdi & Davood, (2023), Mustafa, (2020), J. Prusa, (2001).

The first, approach advocates for freedom and the removal of all restrictions on international trade, as it leads to greater economic welfare (Rodrik, 2011).
The second, approach calls for protectionism and sees the necessity for state intervention and the use of its authority to influence international trade and its volume, or to settle trade disputes. It is recognized that there is no absolute form of freedom or protectionism in trade policy, as they are often blended to varying degrees (Stiglitz, 2002).

To begin with, the concept of international trade policy: there are numerous definitions of international trade policy, all leading to the same objective. Some define trade policy as "the set of means used by a state in its trade within its external relations, with the aim of achieving specific national goals" (Gandolfo, 2014). These goals vary depending on the level of economic development. In advanced countries, the purpose may be to achieve full employment as

proposed by Keynesian analysis, while in developing countries, trade policy is often used to serve economic development (Suranovic, 2017). The agricultural trade policy is the most important because of its importance in revitalizing the countryside, improving income, attracting investment, fighting poverty, and improving food security. As evidenced in Figure 15 the relationship between agricultural development, living standards, and poverty reduction

Figure 15: Relationship between Agricultural Development, Living Standards, and Poverty Reduction



Source: Authors' own elaboration based on Boyden & Dercon, (2012).

Foreign economic policy refers to the activity undertaken by a state in the field of international trade with foreign entities. This concept has been present since the early stages of capitalist development. Initially, international economic relations primarily revolved around commodity trade. However, as time progressed, other elements emerged as subjects of international exchange (Mikić, 2019). These elements include the exchange of services, international capital flows, and their associated transformations. The traditional concept of trade policy alone is no longer sufficient to encompass these new developments. A new concept emerged: the concept of foreign economic policy, reflecting the new landscape with its new components (Feenstra & Taylor, 2017). There are two meanings in this field: The traditional concept refers to a state's policy of exchanging goods only with foreign entities (Gandolfo, 2014). The broader concept denotes foreign economic policy, which encompasses a system of economic relations with foreign entities (Feenstra & Taylor, 2017). Foreign economic policy can be defined as measures or laws enacted by the government as a political entity to directly or indirectly influence the volume of trade between it and other countries or affect the quality and direction of trade (Mikić, 2019).

Trade policy is known as the economic policy applied in the field of foreign trade. It encompasses the sum of actions taken by sovereign authorities in the economic realm to achieve specific goals (Suranovic, 2017). Trade policy comprises a set of measures implemented by sovereign authorities in the field of foreign trade to accomplish specific objectives. Measures related to import and export, such as quotas, tariffs, and subsidies, are part of trade policy. A specific definition of trade policy can be formulated as "a set of tools and measures adopted by a state to achieve gains and benefits for its national economy"(Feenstra & Taylor, 2017). Thus, its tools and measures vary from one country to another, with each country seeking to maximize its trade benefits (Gandolfo, 2014).

A country's macroeconomic policy is heavily influenced by its trade policies. The policy impacts the growth of the economy's productive sectors and the creation of job possibilities (R. Rahim & Ali, 2021). Furthermore, trade policy has the potential to create markets for local products, both domestically and internationally, increasing demand for local products and resulting in increased production and employment, which impacts a country's economic growth and GDP. Trade policy is a crucial component of a country's international economic strategy, using specific tools and methods to achieve specific objectives in foreign trade. Through trade policy, a country establishes a commercial policy that governs its commercial relations with other countries. This trade policy is implemented through laws, decision-making processes, procedures, and tools to achieve economic goals (Abd alkader, 2011).

Governments take various measures to protect their industries and increase production, including supporting inputs, outputs, marketing, imposing restrictions on international transactions, and imposing import quotas (WTO, 2012). The rade protection policy aims to restrict a country's foreign trade to safeguard local products and markets from foreign competition (Ali, 2020; S. Khaled, 2014).

However, in Iraq, trade policies after the political and economic change in 2003 did not meet the level needed for the national development of productive sectors. This shortfall resulted from disruption and instability caused by various reasons, including financial corruption and security, administrative challenges, and political challenges. Agricultural price policy is an important policy tool that assists in reducing the price fluctuations and agricultural incomes the agricultural sector suffers from (Ibrahim & Abdullah, 2022). The price policy represents the direct and indirect ways to influence the various components of price, such as indirect taxes, subsidies, fees, margins, and costs. For instance, price stability, one of the main pillars of price policy, reflects an aspect of a stable economy, which is an important tool in raising the standard

of living. Additionally, price policy is one of the significant measures in an economy that direct agricultural production to the optimum level (Ibrahim & Abdullah, 2022).

In Iraq, the agricultural price policy aims to incentivize farmers to produce sufficient quantities of main crops to supply food, thus reducing the food gap between locally produced amounts and consumption (Noori & Hiyali, 2019). While the policy has succeeded in achieving some of its goals, it has also failed in others due to weaknesses in the procedures accompanying their implementation, alongside social and political conditions. In instances where the implementation of the policies has succeeded, it has had a range of effects on Iraq's national economy. For instance, the agricultural subsidies policy has generated both direct and indirect effects on the economy. The subsidy policy has indirect impacts on upward and downward trends within the industrial sector. It supports production inputs like fertilizers and pesticides, as well as agricultural and food industries (Noori & Hiyali, 2019). Janabi et al. (2023) go on to say that corn is one of the most significant crops in Iraq in terms of livelihood. As a result, the government focused on its production by supplying some fundamental production requirements at subsidized and reduced costs. Furthermore, the Iraqi government has encouraged crop marketing to ensure increased demand, availability, and purchase at higher subsidized costs than international prices. This has resulted in increased public expenditure while slowing the expansion of public resources, as well as pricing distortions (A. Janabi et al., 2023).

The Iraqi government's agricultural support product price policy directly supports agricultural commodities and food production. "This policy is designed to boost production in order to meet the food demands of the population" (Norsida, Hassan, et al., 2017). Due to low production in the country, the state meets the demands of its consumers through imports. The government intervenes by paying a premium to boost production and decrease dependence on imported agricultural products. This support enables consumers to purchase items from local producers at attractive prices, ultimately promoting sustained production. The state subsidizes the selling price of agricultural products to match the support cost per unit (Bayati, 2007).

Furthermore, the policy of supporting input and output prices is another notable agricultural trade policy. The goal of this policy is to encourage producers to increase local production by reducing production costs. Notable production inputs considered by the policy include veterinary medicine, sterilizers, and concentrated feed, which are important in meat production. The government imports these inputs and provides them at a subsidized price, covering the price difference between the sale price and the actual cost of the inputs (Norsida, Radam, et al., 2017).

Agricultural marketing policy is an integral part of agricultural trade policy, as it plays a crucial role in providing marketing services, including transportation, storage, sorting, packaging, and financing of commercial transactions. These services have a substantial impact on the development of agricultural goods and products, benefiting both consumers and producers economically. Furthermore, the policy aims to achieve market efficiency of agricultural goods through price stability, waste reduction, and providing goods to consumers or inputs at the lowest price attainable. However, many farmers in Iraq do not realize the importance of adding value to their products, resulting in low profit margins and product damage before reaching the market. Therefore, the state has established numerous marketing institutions and channels to facilitate marketing (Norsida, Radam, et al., 2017).

6. Conclusions and Recommendations

The results of the current study have a number of implications for agricultural policymakers, practitioners, and stakeholders in Iraq. Firstly, as the findings reveal, allowing import dumping can have negative implications for Iraqi agricultural output at a national level. Therefore, government authorities within the Ministry of Agriculture must do all they can to stop such activities (Hanoush, 2013). Subsequently, heavy and strict tariffs and protective policies need to be imposed on every foreign commodity, especially those that are being imported in large quantities, as well as the need to implement and strengthen technical barriers and sanitary and phytosanitary policies (Shaban et al., 2015).

The effect of these policies should be monitored by transferring the competences of these two sectors especially the Iraqi State Responsible for Industrial Research and Government Institutions, as well as Iraqi Agricultural Associationsby enabling them to assess the effects of these policies fully (Norsida, Radam, et al., 2017). Finally, within 10 years at most, a periodic assessment of the review of the effects of these policies will be conducted (Attabi et al., 2020). The main objective is to establish a mechanism or authority responsible for following up and interacting with the global economic structures and partners while taking into account the priorities and interests of Iraqi society (Babili, 2012). However, if the government is unable to take stringent measures to protect local industries, it has a number of other measures it can take to protect the local farmer. (Musawi & Musawy, 2020). (Ghadhban & Jbara, 2019).

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4. Advantages of implementing contract farming in Iraq

Advantages of Implementing Contract Farming in Iraq

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Abstract

This research aims to explore the advantages of implementing contract farming in Iraq and analyze its potential impacts on the agricultural sector. The study focuses on how contract farming can improve farmers' incomes, stabilize prices, and increase agricultural productivity. Contract farming can enhance farmers' access to markets and modern agricultural technologies. The study examines economic and social benefits, alongside the challenges of implementation, particularly given Iraq's fragile agricultural infrastructure. Based on a review of the current literature, the study finds that contract farming presents a crucial option for developing Iraq's agricultural sector by providing sustainable support to farmers and reducing marketing and production risks. The research emphasizes the need for a partnership between the public and private sectors to ensure the success of this strategy, with policy recommendations aimed at improving the efficiency of the agricultural system and supporting local farmers.

1. Introduction

Contract farming is an important agricultural policy that aims to achieve food security by enhancing agricultural production and improving crop quality. This type of farming is based on signing agreements between farmers and companies or buyers to grow a specific crop according to pre-determined conditions. The contract farming model is very popular in many countries due to the economic, social and environmental benefits that can accrue to everyone (Meemken and Bellemare, 2020).

The concept of contract farming evolved directly from shifting market demand, with specific goods produced by a group of producers being demanded by a specific buyer. The essence of the enterprise-based relationship is the identification of a group of firms that have the willingness to supply products in a reliable and consistent way to a financially viable venture. Contract farming is an important entry strategy for many farmers aiming to reduce risk in a less stable and changing marketplace. It is also a means by which vertically producing companies can source products at a price and level of quality and quantity required (Ncube, 2020). Another rising interest in contract farming is that such arrangements

are seen as a means to protect, or at least leave in farmers' hands, the means of production. Contract farming developed not only as a response to investment constraints but also as a way of ensuring food security. Contract farming has also been present – increasingly so – in international discussions on rural development generally and poverty in rural areas more specifically. The main stakeholders involved in contract farming are the producer, the buyer, and the consumer (Mahmud, 2021).

The question of the study is: How does contract farming contribute to improving farmers' incomes and increasing agricultural productivity in Iraq?

Iraq is known as an agricultural country since ancient times, and agriculture is one of the few ecosystems that the country is rich in (Mahmud, 2021). Agricultural wealth allows Iraq to produce most crops, and this diversity in the production of crops points to the importance of the agricultural field in Iraq. At the same time, the agricultural sector receives less attention than other economic sectors targeted for appropriate development, whether quantitatively or qualitatively (Al-Ansari et al., 2021). Given the situation of the weakness of the industry and the aspects of the other economy in the country, and in a way that is parallel to the concept of development from within, it is necessary for the Iraqi Academy, as well as economic experts and those interested in Iraq, to consider another perspective on the development of the agricultural sector other than the perspective that focuses on the development of the upstream sectors, and the knowledge of the role of contract farming as one of the tools that contribute to the reform of the system of soil rotations and the transformation of production, as well as to achieve the main objectives of the research (Ncube, 2020). The essay is divided into several sections, each with the objective of examining the benefits of some aspects of contract farming and then examining to what extent they represent a solution to some of the problems of the Iraqi agricultural sector. Finally, it will examine the positives and negatives of all the sections that were analyzed in a contract and whether contract farming can contribute to changing the production system and productivity in the region, leading to the development of the agricultural sector in Iraq (Hasan & Perot, 2021). This includes the changing seeds and agricultural systems that lead to the production of coarse grains or the implementation of a free economy that gives the private sector the freedom to control the agricultural field (de Janvry & Sadoulet, 2020). This method allows large merchants and companies to buy crops from farmers at a later time, usually at harvest time, when the crops are ripe in large quantities and stored by local merchants for a period until they reach the so-called free price (Meemken and Bellemare, 2020). The phenomenon of adopting contract farming is considered a solution to finding an appropriate farm environment and overcoming this dilemma (Chen & Chen, 2021). If contract farming is implemented in Iraq, this will

represent a promising solution for Iraqi farmers who suffer from many marketing problems, whether it is an exhibition of their products to internal markets or foreign markets (Albaaji & Chandra, 2024).

2. Literature Review

A study conducted in India focused on the significant role of contract farming in increasing productivity and development. However, it demonstrated that contract farming projects need a legal and social structure that supports such an idea; they are linked to social and legal contexts. That is, the benefit may be for large projects that are acquired by companies willing to undertake this production, while the role of small-scale farmers with limited capabilities is deliberately neglected. This point is particularly relevant in the context of Iraq, where ensuring equitable access to contract farming opportunities is of paramount importance (Motkuri & Naik Veslawatha, 2005).

The study also points out that large companies tend to favor larger farmers in their contracts, raising questions about fairness in agricultural development. It calls for agricultural policies in Iraq to be more inclusive, ensuring that small farmers benefit. The research emphasizes the importance of localized assessments of contract farming, as policies must be tailored to fit Iraq's unique socio-economic environment (Motkuri & Naik Veslawatha, 2005).

Another study analyzed the dynamics of contract farming in Tanzania, focusing on the imbalance of power between farmers and companies. Despite the potential benefits, such as improved access to inputs and markets, the study reveals that contracts are often designed to favor companies, leading to an unequal distribution of gains. The study recommends strengthening farmer groups to increase their bargaining power, and it highlights the need for effective governance structures to protect farmers from exploitative practices. These recommendations are significant for Iraq, where similar issues might affect contract farming initiatives (George, 2017).

Building educational and training programs for farmers on how to manage such projects and study contracts is of utmost importance. This will strengthen the path to increasing production and the ease and speed of implementing these ideas, especially in social contexts such as Iraq (George, 2017).

Another study examined the factors influencing agrarians' intention to adopt contract farming in Iraq. It highlighted challenges such as limited market access, price instability, and the role of intermediaries. These factors create uncertainty, preventing farmers from engaging in contract farming. The study suggests that improving supply chain collaboration is essential to overcome these barriers and promote the adoption of contract farming as a strategy to enhance agricultural productivity (Khalili et al., 2024).

In conclusion, the literature highlights the complexities of contract farming as a tool for agricultural development in Iraq. While it offers potential benefits like improved productivity and market access, significant challenges, including power imbalances, governance issues, and market inefficiencies, must be addressed to ensure its success. Iraqi policymakers should consider these challenges when designing agricultural policies to ensure that smallholder farmers are empowered and can effectively participate in agricultural markets.

3. Overview of Contract Farming

Contract farming is a modern agricultural system based on an agreement between the farmer and the buyer on the terms of growing and marketing agricultural products. The details of the contract are determined, including the quantity of the crop, the required quality, delivery dates and agreed prices. The goal of contract farming is to achieve sustainability of agricultural production and increase income for farmers in addition to ensuring the quality of products for buyers (Ye et al., 2020; Bijman et al., 2020). The common ingredients of these definitions reflect the key elements that constitute a contract farming agreement. These key elements can be summarized as follows (Wang et al., 2021). A. Specification of Products and Quality: It involves the type and varieties of product(s) to be produced. B. Pricing Mechanism: It describes the pricing arrangement, such as cost-plus contract or fixed price, base price or premium price, mode of payment, and profit sharing (Kumar et al., 2020). C. Quantity or Volume of Supply: It specifies the quantity of production expressed in physical units. D. Time of Supply or Delivery Schedule: It contains the time dimension, which includes the period, frequency of collection, and the marketing arrangement. E. Conditions and Matters Concerning the Contract Itself: It includes the duration or period of the contract, penalty clauses, and matters dealing with termination and default. F. Role and Responsibility of Each Party: The responsibilities of the farmers are mainly towards the production of good quality products and legal production, while the buyers or companies are involved in the purchase of marketable surplus (Giller et al.2021; Li et al., 2020). As evidenced in Figure 1, the representation summarizes the key elements of contract farming alongside the responsibilities of both farmers and buyers.

Figure 1: Responsibilities in Contract Farming

Key Elements	Farmer Responsibilities	Buyer Responsibilities
Specification of Products & Quality	Ensure Product Quality	Define Quality Standards
Pricing Mechanism	Production Costs, Adherence to Price	Pricing Terms and Payment
Quantity or Volume of Supply	Meet Quantity Requirements	Determine Volume
Time of Supply or Delivery	Timely Production	Schedule Collections
Conditions & Matters of Contract	Legal Production, Compliance	Contract Terms, Penalties
Role & Responsibility	Provide Marketable Surplus	Purchase Marketable Surplus

Source: Authors' own elaboration based on Giller et al., (2021), Li et al., (2020), Kumar et al., (2020), Ye et al., (2020) and Bijman et al., (2020).

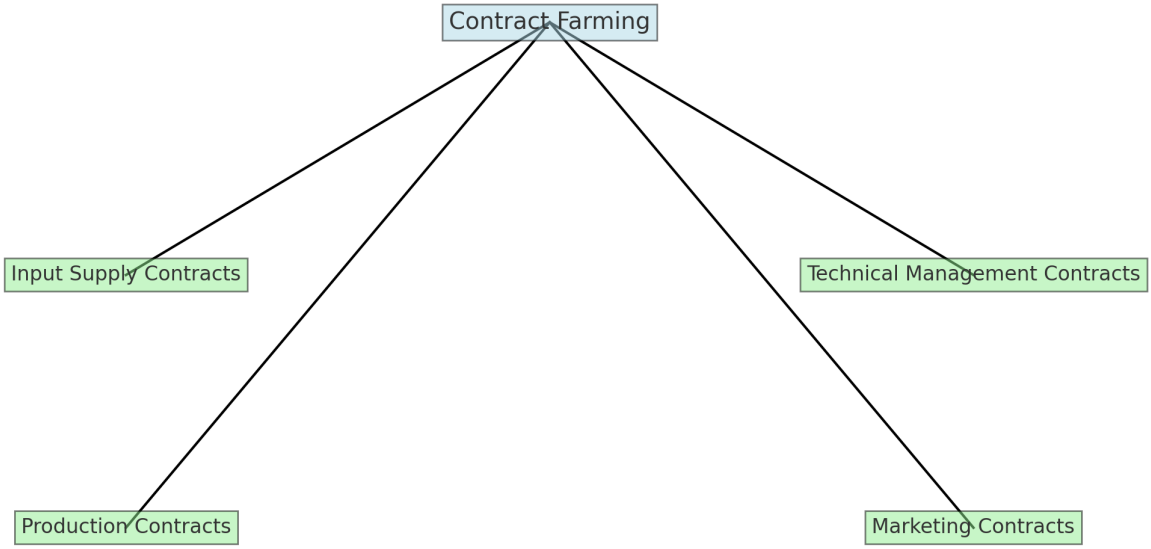
These pillars will help build a strong relationship between the buyers and the farmers. Above all, these define the operative part of the contract between the buyer and the farmer. The clearer and well-documented these aspects are, the lesser the grounds for arbitrary rejection of produce resulting in conflict (Martiniello et al., 2022). Farmers and buyers use a contract to record the agreement of both sides. For success, these matters must be negotiated in good faith, and ultimately, the two parties must agree on them. Once a contract is signed, the farmer must produce the crop(s) according to the buyer's specifications, that is, the conditions given in the contract. The buyer's role is to apply all of the research and manufacturing capacity at the company's disposal to enable the farmer to achieve these targets. At the very least, this means satisfying the farmer's need for information and inputs and ensuring that a definite buyer will be available on an agreed delivery date to accept the contracted produce (Kumarathunga et al., 2022). Then, management at all levels must monitor the execution of the contract to ensure that both sides' obligations are fulfilled and, if not, to take corrective action (Kohl, 2020).

The concept of contract farming is simply summed up by a contract and agreement between the producer of the agricultural commodity and the buyer, such as an agricultural company, for example. An agreement is made in advance to supply a specific commodity with specific specifications, prices,

conditions and delivery time. Contracts between producers and buyers based on pre-determined terms and conditions ensure stability in supply due to knowledge of advance demand. Producers have easy access to the market and receive payments that enable them to access quality inputs such as seed varieties, modern mechanization technology, etc. (Meemken & Bellemare, 2020). Contract farming increases production and reduces losses, which ensures sustainability and activates investments among the poorest environments, making it a fertile base for investments and expansion of agriculture and income in general (Zhang, 2020).

Contract farming refers to an agreement made between farmers and buyers over the supply of farm produce or livestock through a contract (Chen & Chen, 2021). It uses contract farming when farmers work with contract farms in which purchasers use contractual terms to direct the nature of farmers' production. There are currently four types of contracts, described as follows: First, "Input Supply Contracts" includes contracts between suppliers and farmers, and it also regulates the supply of inputs required for the production of goods to farmers. Second, "Technical Management Contracts" refers to an agreement with a party that provides farmers with management advice. Although the advice is technical in nature, it mainly regulates the final nature of the farm products (Meemken and Bellemare, 2020). Third, "Production Contracts" includes contracts that regulate the sale of farm inputs and the purchase of farms after slaughter. Fourth, "Marketing Contracts" regulate the release of farm inputs to farm production companies, but they do not regulate sales directly (Chen & Chen, 2021; Yi et al., 2021). Figure 2 represents the types of contract farming, showing the connections between contract farming (as a central concept) and the various types, such as input supply contracts, technical management contracts, production contracts, and marketing contracts.

Figure 2: Types of Contract Farming



Source: Authors' own elaboration based on Meemken and Bellemare, (2020), Chen & Chen, (2021) and Yi et al., (2021).

The main objective of the contract is to try to stabilize the supply of raw materials, especially in farm production. A mutually beneficial financial risk-sharing agreement between the bank and the borrower is a potential stabilizing factor (Bottoni et al., 2020). In countries where a lot of export marketing goes on, the bank must help reduce the risk of export contracts. In the world, contract farming is receiving continuous attention in several countries due to its ability to improve the efficiency of agriculture, reduce transaction costs, and manage risks in a firm, as a result of promoting linkages between processing and marketing firms, the private sector, and governmental programs, such as privileges given to a constant monetary sector and a conducive legal environment (Chen & Chen, 2021). The judgment lets contracts with friends: long, especially production and marketing. Specific particulars vary from country to country as a result of the government majorly depending on them (Khan, 2022).

Governments may further regulate contracts relating to property laws, human rights, trade, and consumer protections. In some countries, credit law has further enhanced safety measures between contracting parties (Martiniello, 2021). The benefits of contract farming may come in several economic forms. These include increasing access to key inputs such as technical advice or credit; improving the quality (and hence value) of outputs; providing price and market risk reduction, price stability, and higher prices for contract production (Ren et al., 2021). A discount or premium to open market prices may be given for

quality and predictability for the products produced under contract (Zhang, 2020). Adverse selection of farmers or monitoring agents might increase. Consequently, the principal may receive a higher rent by exercising more ex ante effort when choosing a superior farmer (Lan et al., 2022).

One of the major benefits of contract farming is that it can increase the income of farmers. Contract farming provides a guaranteed market for the products of the farmers. This helps in price stabilization for the farmers, as the price of the commodity is determined in advance; this would insulate the farmers from the price risk associated with the volatility of product prices in the market (Hoang, 2021). Contract farming provides greater links to capital for the farmers at relatively lower costs. Contract farmers have a twofold advantage as they can obtain their credits from institutional or non-institutional sources at lower interest rates and petition banks to give them loans on the background of a guaranteed contract (Ruml et al., 2022).

Buyers also usually provide better extension services or advisory services and linkages to resources such as inputs and machinery, technology, and capacity building and training of farmers. Enhancing the effectiveness and efficiency of the farmers is linked to their socio-economic status. The improved technology accompanied by adequate training is important. The extension advice enhances the capacity of the farmers to have proper crop management, hence good yields. However, some inherent challenges can also be cited with contract farming (Magesa et al., 2020). Farmers can develop dependency and be under the authority of the buyers due to financial support or other support services they receive. Some buyers can also exploit the farmers due to their dire need for money. In addition, the minimum price is usually below costs. Fluctuations in communication and market requirements for productivity and product quality can occur. In this case, the buyer has the right to change the price or reject the performance that does not address their needs (Glavee-Geo et al., 2022). This is a form of financial risk for farmers. The health of the farmer also seriously influences the business and can affect the raising of the crop yield or even, in some cases, influence the final crop yield. The associated pollution, for example, toxic plant insecticides, is also harmful to the farmer and the public as a whole in terms of quality. If the farmer in this scenario could not meet the contract requirements because of illness or other natural disturbances, they may no longer be able to meet the contract terms. A way back farm strategy must be produced to offset some of these hazards (Fan and Rue, 2020).

The legal framework, or regulations, is one of the most important aspects of contract farming to ensure fair and valid contract practices. Based on the types of laws and legal regulations, an agricultural contract can be governed by different types of regulations, namely in the form of privately determined rules of law, government regulations, and international rules. In addition, a country or region may also have additional regulations to ensure more effective management of agricultural contracts (Ncube, 2020). Currently, there are some available international or local laws and regulations that govern various agricultural contracts or food supply chains, either directly or indirectly. The laws and regulations in the field of agricultural contracts or food supply chains can be broadly seen in several main points. In fact, the agricultural contract must comply with both international and local laws and regulations related to the contract or food supply chain (Michler & Wu, 2020).

Many public agencies are in charge of providing surveillance or enforcement of agricultural contracts in a country. Therefore, if there are problems that arise between the parties because of violations of agreements or contracts, the parties or the authorities have the right to report the violations to the relevant institutions (Van et al., 2021). Compliance with the law of an agricultural contract is very important because it has the potential for white-collar crime, with more and more being neglected legally in agricultural contracts or commercial disputes based on the law of the agricultural contract. Although it has been conducted properly, if one of the contractors wishes to make a claim by relying on a legal system, then it is certainly not guaranteed that the ruling will come soon (Bijman et al., 2020). One of the fundamental aspects of the contract is that a valid system must always exist within it. A contract must obey the laws and regulations that apply in a specific region or country. In addition to ensuring the clarity of contracts as much as possible, laws can also be used to ensure the balance between the two parties in the contract. For developing countries, contract farming is often faced with challenges that need to be addressed from a legal perspective, such as the level of understanding of contracts and law, and the availability of legal services at the farm level (Breyer et al., 2022). Farmers and the companies involved in contract farming need to understand the legal implications of the agreement they have reached. The lack of legal understanding can leave a trail of unequal contracts for farmers.

4. Current Agricultural Landscape in Iraq

Securing one of the earliest agricultural civilizations on the planet, Iraq has a long tradition of harvesting and sales that is divided into investor farming, subsistence farming, and cooperative farming. To a great degree, these two traditions continue right up to the present day (Muhialdin et al., 2022). The investor

farmers use machinery and technology similar to the rest of the region, while the use of conventional machinery and methods and the concentration on a couple of rain represents several of the challenges facing peasant farming (Cao et al., 2021). In other regions, the agricultural industry is likewise just recovering from the destruction of decades of restored investment in the sector that did not appear to gain energy (Mentis, 2020).

Much of the farmland in Iraq runs at well below capacity, putting out an average of 30 percent of world production levels. There are several reasons for this, including the lack of investment, low seed input, or low use of fertilizer (Abdulridha & Alkarawy, 2022). Much of the circulation network and the core of the Iraqi agricultural industry is obsolete. Irrigation plans are also often observed to be close to failure and require massive capital expenses (Al-Muqdadi et al., 2021). The farming industry is not the only industry that has seen a low level of state spending in the last 15 years because roads, electric systems, and sewerage companies all require restoration. Because of the unpreparedness of many farmers to invest in the agricultural landscape, the private economy is unlikely to come to the rescue of Iraqi agriculture (Cordesman, 2022). Because projected revenues are not insured for many farmers, they prefer to hold back on financing key farming inputs such as equipment, seed, and fences. Besides the absence of farmer commitment, other factors played a key part in the slow growth of the agricultural sector. These include faulty water management and the drainage system, which removes up to 90 percent of water from important cropping fields (Elaiwi et al., 2020).

5. Advantages of Contract Farming in Iraq

Contract farming is an arrangement between agriculture producers and buyer companies for the supply of agrarian products under familiar contracts, frequently at predetermined values. It is gaining popularity and has several advantages for developing countries (Adnan et al., 2020). Many highly diverse cash crops, be they grains, fruits, or vegetables, are now generally produced under contract conditions. Investment from a foreign country can support the transfer of new technology to local farmers under the contract farming system to reduce costs, reduce post-harvest losses, increase cooling storage life, increase the value chain, increase daily goods movement turnover, and increase the income of agribusiness farmers (Ikram et al., 2021). For farmers, the most important benefit of contract farming is market access. This arrangement represents a commitment from an agribusiness to purchase the crop even before it is grown, hence guaranteeing a market. By entering into a contract, the farmer has a clearer idea of what price can be expected and also some security on the disposal of the produce. By receiving technical as well as financial advice, the farmer is in a better position to reap the expected benefits (Meemken and Bellemare, 2020). For the agribusiness, contract farming offers better quality raw

material without the risk of a volatile market, as well as the opportunity to develop long-term partnerships with farmers for a steady supply of raw material (Hasan & AL-Shammar, 2020). Other benefits of contract farming include risk reduction for the farmer, who is less weather-dependent due to guaranteed orders, and investment in the farmer by the agribusiness, which has enabled improved technology, increased land size under cultivation, speculative investment, and cutting out middlemen. For the consumer, the advantage would be access to quality produce at competitive prices (Ye et al., 2020; Pham et al., 2021).

The implementation of contract farming in Iraq will have several advantages and benefits for the locals. Iraqi farmers will benefit from economic, social, and environmental aspects. This study discovered several key advantages of implementing the process, which will be discussed in the following subsections (Al-Obaidi et al., 2022).

Contract farming can stabilize farmer income and completely remove price risk for the farmer. This would allow the farmer to plan their life with a much higher degree of certainty, i.e., the 'buy now, pay later' agreement. Improved structural investment in agriculture in the form of capital investment made available by agribusinesses for property and infrastructure, e.g., fences, yards, water reticulation, etc. Infrastructure investment could be incurred directly by agribusinesses (Ren et al., 2021). There is a greater appeal for banks to lend for structural improvement on farms, resulting in bigger negotiation power for farmers due to larger equity (de Janvry & Sadoulet, 2020). Agribusinesses can take credit risks at low costs. By purchasing property and helping farmers in the production process, agribusinesses and, therefore, small to medium farmers may derive economies of scale. Decreased costs per kg due to 'bulk purchase' advantages. An opportunity and the possibility for agribusinesses to assist in farming development regarding previously disadvantaged communities (Adobor, 2020). More creative marketing opportunities for private labels, branded produce, or take-home packaged, family-oriented food products (Esteky, 2022).

As a result of operations being larger due to the involvement of more ecologically expanded regions, contract farming could aid improved rural development through job creation. An increase in on-farm production would create employment (Meemken and Bellemare, 2020). This would manifest regardless of whether individual farmers undertook the operation or whether it was executed by one dominant agribusiness, i.e., modern farming methods and techniques. Improvement in the material environment. Increased sales of material possessions such as food, fuel, and stock feed would result in increased local retail business (Vadakkepatt et al., 2021). The benefits of implementing infrastructure could possibly

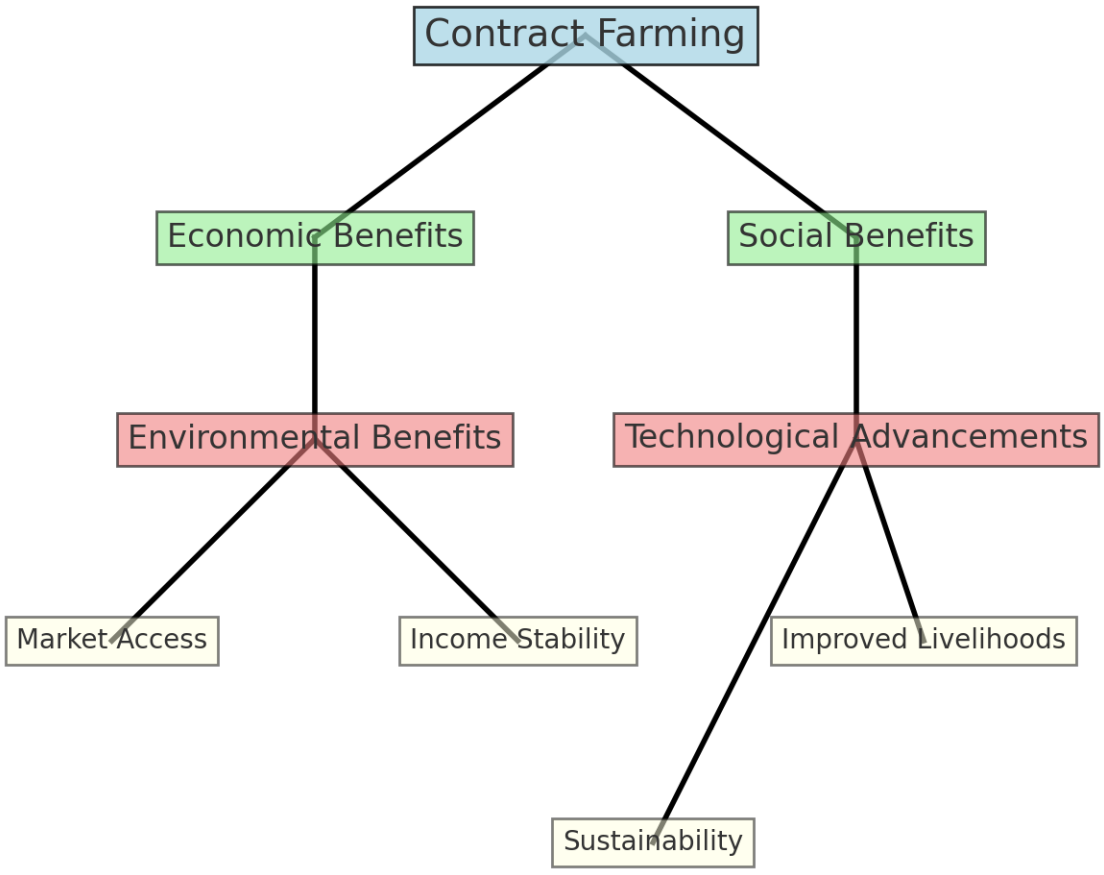
provide a platform for export. Increased foreign income through foreign exchange. Increased employment. Increased Gross National Income (GNI). Gains for the local economy (Abdlaziz et al., 2022).

Modernization is critical for promoting development and increased productivity. This subsection outlines why high-tech machinery, processes, and training of labor farmers are crucial for modernizing agribusiness in Iraq (Ballatore, 2021). The destruction of numerous farms during the war has led to a significant shortfall in essential machinery. In the aftermath of the tumult, contemporary agricultural equipment was designed to withstand the threats posed by landmines, which have continued to hinder agricultural development. Collaborative efforts between agribusiness entities and farmers have facilitated farm owners' access to advanced, state-of-the-art agricultural tools, ultimately enhancing their productivity and efficiency in farming operations. (Amanah et al., 2021). Involvement in agribusiness has already helped in organizing and sponsoring the training of farm owners, local staff, and companies in modern farming practices and the effective utilization and practical know-how in the use of machinery (Barnard et al., 2020). To help develop existing trends, managers at both companies are looking into ways to collect and process the data that the farming equipment produces. Raw data gathered from the farms and used in the report aims to provide growers with a service that will give cash for actual on-farm income loss (Neethirajan & Kemp, 2021). While it is still currently a trend, with the desire to start the farming journey, the potential to increase production and reduce costs through using technology is significant (Osinga et al., 2022). The company's move to establish a similar service that will provide information on the likely yield of seed is also important (Fragapane et al., 2022). Modernization is a crucial aspect of developing Iraqi agribusiness. Companies are heavily investing in the growth of the country’s farming from large plots of land upwards (Smith & Robertson, 2023). Training farmers to work effectively will also bring them into the culture of agribusinesses, ensuring that they raise their standards to match those required for exporting. Rebuilt farms should also be updated with the machinery and structures to allow for global throughput and the ability to keep up with modern global requirements. This is all made possible by the training of the farmer and his manpower (Meemken, 2020).

Agribusinesses collect a large quantity of data through consumers but also from the farms themselves. When this data is used effectively, it can increase production and implement preventable practices for other systems such as water. The companies helping to fund this development also look to make sustainable land use and safety a priority (Bhat & Huang, 2021). Any damage farmers cause to the land

can result in the loss of their employment at the companies producing food - land must be protected. Through their use of data, anti-pollution schemes now clean up water used in farming to increase the amount of water available (Javaid et al., 2022). This water is built as part of a circular watering system and bypasses requirements for order from rivers, which would add cost. The deployment of modern technologies also makes it possible to develop farms into a fair and safe working place - an environment no longer associated with generally working in agriculture (Sharma et al., 2022). Figure 3 highlights key benefits like market access, income stability, and sustainability, along with the primary economic, social, environmental, and technological advantages. Each stage is interconnected to show how contract farming positively impacts various aspects of the agricultural system.

Figure 3: Benefits of Contract Farming



Source: Authors' own elaboration based on Javaid et al., (2022), Sharma et al., (2022), (Smith & Robertson, (2023) and (Bhat & Huang, (2021).

Contract farming may also strengthen the social fabric and contribute to greater social capital in rural communities. Contracting within rural communities is often collective, with neighbors jointly negotiating, arranging, and coordinating the transport of pickers to the point of work. Similarly, the emergence of contract farming in regions is underpinned by many such cooperative interactions (Ray et al., 2021). Further, the very institutionalization of a competitive enforcement process within rural communities can generate social capital, support networks, and logics of collective action among the weaker. Many poor owe their productive resources to their richer or better-educated peers and relatives within the community who act as patrons. The potential for cooperative outcomes in preventing environmental damage has been noted (Rigolini & Huse, 2021).

Although there are circumstances under which contract farming has significant potential benefits in providing the locus for more women to achieve status in agriculture and its allied industries, there are many other cases in which contract farming may serve to reinforce existing relations and norms with respect to the division of labor between the sexes (Martiniello, 2021). There are positive and negative social impacts of contract farming at the household level. While some households can participate in contract farming and access wage labor markets and also provide off-farm work, improving their living conditions and their capacity to pay dowry, other households, who cannot participate in contract schemes, are more and more vulnerable due to debt accumulation and increasing reliance on food delivered by contractors (Meemken and Bellemare, 2020).

There is also a very contentious literature addressing the social impacts of large-scale agriculture associated with contract farming. In this literature, there is continued concern about the role of family farming in countries. The proposed amendments based on a perceived ideal of the quaint family farm are largely irrelevant to the nature of farming. Similar discussions are not couched in terms of the need to maintain a "family farm" sector, but there are similar attempts to "re-territorialize" farming, partly on the basis of social and political considerations (Mizik, 2021).

The social impacts of contracts vary with the decisions that are taken, contracts that are on offer, and the varied socio-economic contexts in which contracting occurs. There is a strong need for more research in this area so that safety nets can be developed that will protect smallholders from some of the less favorable outcomes of contracting. In this way, the social impacts of contracts flow back to assess the institutional environment (Heydemann, 2020). If this is unfavorable, then it can be expected that all the potential negative social implications of contracting become evident. Given the importance of the socio-

institutional environment, the least developed contracts theory does not ignore it. As well, it can be said that as with many aspects of agricultural production and marketing, where volumes outweigh administered marketing and other contracts, a standard perfect competition model is in many instances the logical starting point. In the case of the economic role of farmers and aggregated contracting effects, this need not apply, however (Loewe et al., 2021).

6. Conclusion

In conclusion, if implemented properly and collaboratively by the government and private sector, contract farming can be an effective tool for farming in Iraq. It would offer a wide range of direct and indirect advantages to local farmers (Hamasalih and Layeeq, 2023). The most significant direct contribution would be providing farmers with a fair price, creating economic stability, and reducing dependencies on loans. Besides, it builds on capability improvement, productivity progress, and technological advancement (Mahmud, 2021). Each case study clearly showed that the adoption of contract farming has made a transformation that is not possible within the traditional agricultural marketing system. Although this essay discussed more advantages than barriers to implementing contract farming, it should be noted that large-scale adaptation faces many complicated challenges (Chen & Chen, 2021). Overcoming these barriers requires a range of support policies from the Iraqi government and changes in the thinking and behavior of farmers, especially smallholders.

Based on the module discussions, this essay has directly and indirectly tackled the advantages that Iraqi farmers would receive as a result of contract farming agreements. The cooperation between the farmer, agribusiness, and government would be ideal if it is a real case (Albaaji & Chandra, 2024). An adaptation of this system needs to be encouraged and regulated by the central government, recommending amendments to the law of contracts. Science graduates studying at the college must have easy access to the contract, educate and advise farmers on how the contract farming system should work in practice, and capacity-building programs must be provided accordingly (Abbott & Snidal, 2021).

This paper examines the historical development and current situation of contract-farming schemes for milk production in the central-west region of Brazil's sprawling State of Minas Gerais. It offers an in-depth analysis of the contractual arrangements between small cattle producers, referred to as milk suppliers, and the large agrifood enterprises and their local buying agents, known in Brazil as lacticínios. The paper adopts an ethnographic perspective, delving deep into the activities, experiences, and aspirations of milk producers in the rural Municipality of Campo Belo. It argues that whether or not a

contract is in writing what farmers and dairy enterprises create through their practice of contracting is a relationship of considerable intensity. Despite the contractual complexities and contradictions, each contract can be seen as a protective shield for each party, keeping out inclement weather and the vagaries of a potential misfortune.

The potato value chain in Toba Tek Singh, Pakistan, is increasingly contract-based. Here, as in other contract-farming contexts, actors involved faced myriad challenges as they endeavored to craft win-win settings. The recent evolution of the TTS potato value chain was examined in a value-chain study of inclusive growth. An exploration of contract-farming governance, dynamics, and outcomes was nested within that larger study. This longer paper summarizes that contract-farming case study, which was conducted by the study's field team during July and August 2015. The team talked with all big actors in the TTS potato value chain: elite largeholders, elite farmers (not all of whom are largeholders), smallholders, large traders, and representatives from a company that is active in potato processing in Pakistan and is the subject of one of the case studies in this collection. The team also interviewed some public sector workers.

This study demonstrates that contract farming can be a transformative tool for Iraq's agricultural sector, offering substantial benefits to farmers by providing price guarantees, market access, and technological support. Previous studies, such as, emphasized the general benefits of contract farming, while (Meemken & Bellemare, 2020) focused on social empowerment, and (Zhang, 2020) explored technological innovations. The government should conduct a periodic evaluation of the implementation of the recommendations related to promoting contract farming, where the actions taken should be evaluated and the results achieved and the extent to which they have achieved the set objectives should be studied. Effective follow-up should also be conducted on the implementation of the recommendations and the progress of programs and projects related to contract farming should be monitored. Key indicators and standards should be identified to measure performance and the results should be presented in periodic reports, in addition to providing appropriate recommendations to ensure that the desired objectives are achieved and the necessary measures to address any problems that may arise in the implementation process. The study recommends that the government take several steps to promote contract farming, including providing adequate financing and financial support to farmers who participate in agricultural contracts. Education and awareness programs should also be supported for farmers and companies to understand the potential benefits and risks of contract farming. Rural and logistical infrastructure should also be developed to enhance farmers' capacity to effectively implement agricultural contracts. In addition, research and innovation in this field should be encouraged to improve the productivity and

quality of contract farming products. Finally, the government should conduct periodic evaluations and effective follow-up on the implementation of the proposed recommendations and ensure that the desired objectives of promoting contract farming are achieved. However, our study is unique in its comprehensive approach to addressing Iraq's specific challenges, such as its fragile infrastructure, political instability, and economic volatility. This study goes beyond the findings of previous research by offering tailored recommendations that take into account the intricate dynamics of Iraq's agricultural landscape. The collaboration between the government and private sector, as proposed in this research, is crucial for achieving the full benefits of contract farming. Ultimately, our study provides a more contextual and practical framework for the successful implementation of contract farming in Iraq compared to prior research.

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5. Adoption of internet of things (IoT) in smart farm management: Implications for sustainable agriculture in Iraq

Adoption of Internet of Things (IoT) in Smart Farm Management: Implications for Sustainable Agriculture in Iraq

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Abstract

The Internet of Things (IoT) is revolutionizing agriculture by providing real-time data and insights to optimize farming processes. In Iraq, agriculture plays a critical role in the economy, yet the sector faces challenges such as inefficiency, water scarcity, and low productivity. Despite global advancements in IoT-based smart farming, adoption in Iraq remains limited.

The agricultural sector in Iraq suffers from outdated practices, insufficient technological infrastructure, and a lack of awareness about modern farming techniques. Additionally, high costs of IoT implementation and limited expertise exacerbate the issue, preventing farmers from leveraging IoT solutions to enhance productivity and sustainability.

This research explores the adoption of IoT technologies in Iraq's agricultural sector. It aims to: 1-Analyze how IoT can address agricultural inefficiencies in Iraq. 2-Evaluate the potential benefits and challenges of implementing IoT in the country's farms. 3-Offer actionable recommendations for integrating IoT into agricultural practices sustainably.

The study reveals that IoT adoption can significantly improve resource management, reduce costs, and enhance yields. Specific benefits include optimized water usage, reduced pesticide application, and better disease management. However, barriers such as high initial costs, lack of expertise, and data privacy concerns hinder widespread adoption.

Keywords: Smart Farm Management, Internet of Things, Agriculture, Environment.

1. Introduction

The need for using the Internet of Things (IoT) in a smart farm is unquestionable because it creates a platform to improve agricultural production processes. This permits stakeholders to perceive the best practices by processing data about farms and yield value (Dhanaraju et al.2022). Agricultural efficiency, productivity, and agribusiness opportunities are the main interests of IoT and have very interesting implications (Lezoche et al.2020). Furthermore, the main objective of this paper is to analyze how the application of the concept of IoT can help solve some of the challenges facing the development of the agricultural sector in Iraq, which is unfortunately getting worse. The application can offer a solution for transforming the agricultural sector in Iraq (Saleh, 2020).

Smart farming or modern farming has been an idea for many years before it was named Farmers 4.0. The concept has involved a paradigm that aims to reformulate farming, not just in terms of technologies, but also in terms of ecosystems in which farmers, food processors, researchers, agribusiness stakeholders, and others have to stay connected (Javaid et al.2022). IoT supports helpful data for smartness, managed, value-added agricultural practices. Smart farming, besides its efficiency, has a function to conserve the use of natural resources and environmentally friendly inputs to meet the increasing demand for agricultural products due to the rising world population. Despite agricultural productivity growth, today the world's food supply is threatened by a number of factors, especially environmental changes. Countries in the world need to secure their agricultural sector in a sustainable manner (Dhanaraju et al.2022). This commitment exists in the goal of the 2030 Agenda, among others, to ensure sustainable agricultural production systems. Thus, in the face of complex global challenges, it requires the involvement of all parties, especially among stakeholders within the agricultural sector, toward greater development based on IoT solutions (Shahmohamadloo et al.2022).

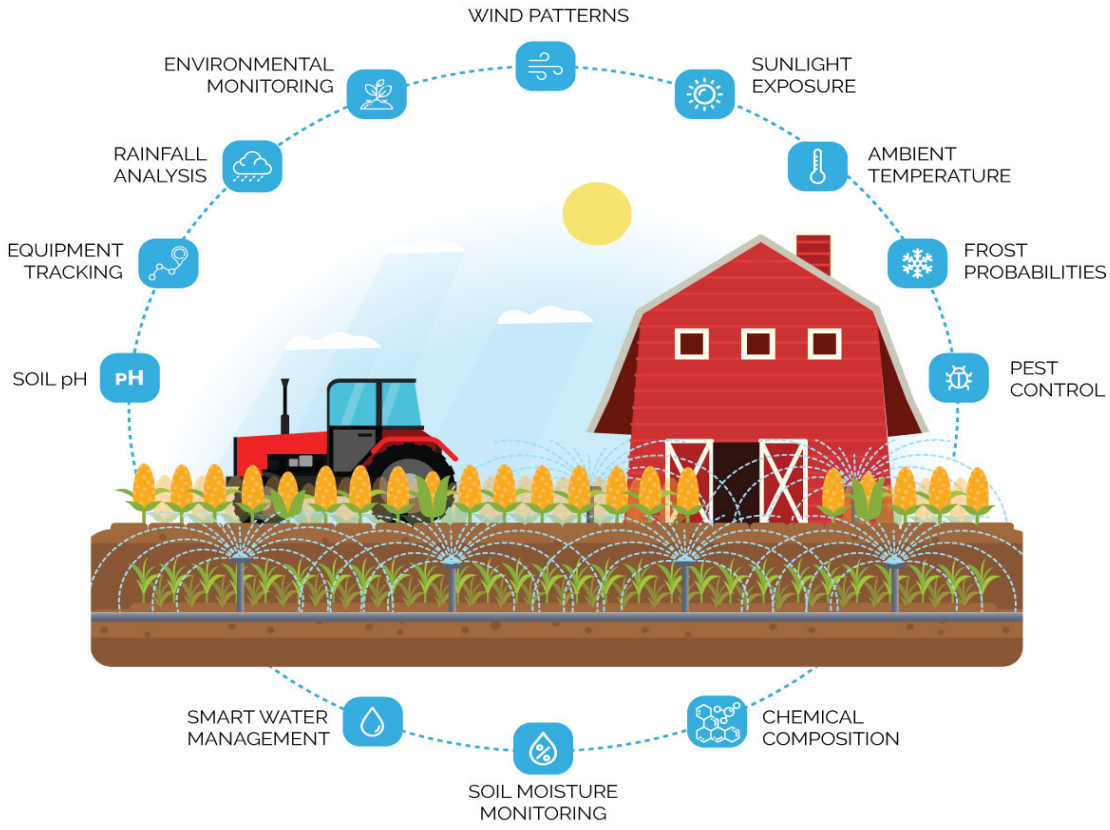
2. Background of IoT in Agriculture

The Internet of Things (IoT) is essentially a network of devices fitted with sensors, software, or other technologies that enable them to connect and exchange data with other systems, software, and devices. Each device or thing on the IoT is fundamentally a system connected with others, often with little human intervention (Kopetz and Steiner2022). Consequently, IoT in agriculture is essentially an interrelated system of things – whether machines, humans, or IT systems – that influence one another and are based on three main components: connectivity, data collection and analysis, and real-time representation. Such components help farmers produce more food more efficiently, with fewer resources and a reduced environmental impact (Bhutta & Ahmad, 2021). The components result in the creation of digital ecosystems that support the service structure of future smart farms. As depicted in Figure 1.

The adoption of precision techniques on a large scale, leading to smart farm management systems, can enhance agricultural sustainability – which is particularly important to emerging economies. IoT systems enable the gathering of substantial amounts of farm data by low-cost automatic sensors as well as various manual data entry points (Karunathilake et al., 2023). These systems allow farmers to make real-time decisions and gradually improve their production systems based on data patterns specifically valid for their farm. This added value presents a wide range of

benefits. Primarily, by using precision farming techniques, the amount of water, fertilizers, and pesticides used by farmers can possibly be reduced, with concomitant savings in outlays and water usage. However, IoT entails some major challenges, essentially rooted in the interaction between human behavior and technology: there is eagerness for technology, but at the same time, impending resistance (Monteiro et al., 2021). Secondly, cost – an initial outlay is a starting point just for the base station of one technology, before adding in other packages or software updates. With IoT technologies constantly changing and improving, users must invest in continuous and possibly expensive – technology upgrades (Dhanaraju et al.2022) As depicted in Figure 1.

Figure 1: Smart Farming Technologies: Enhancing Agricultural Efficiency and Sustainability through IoT and AI



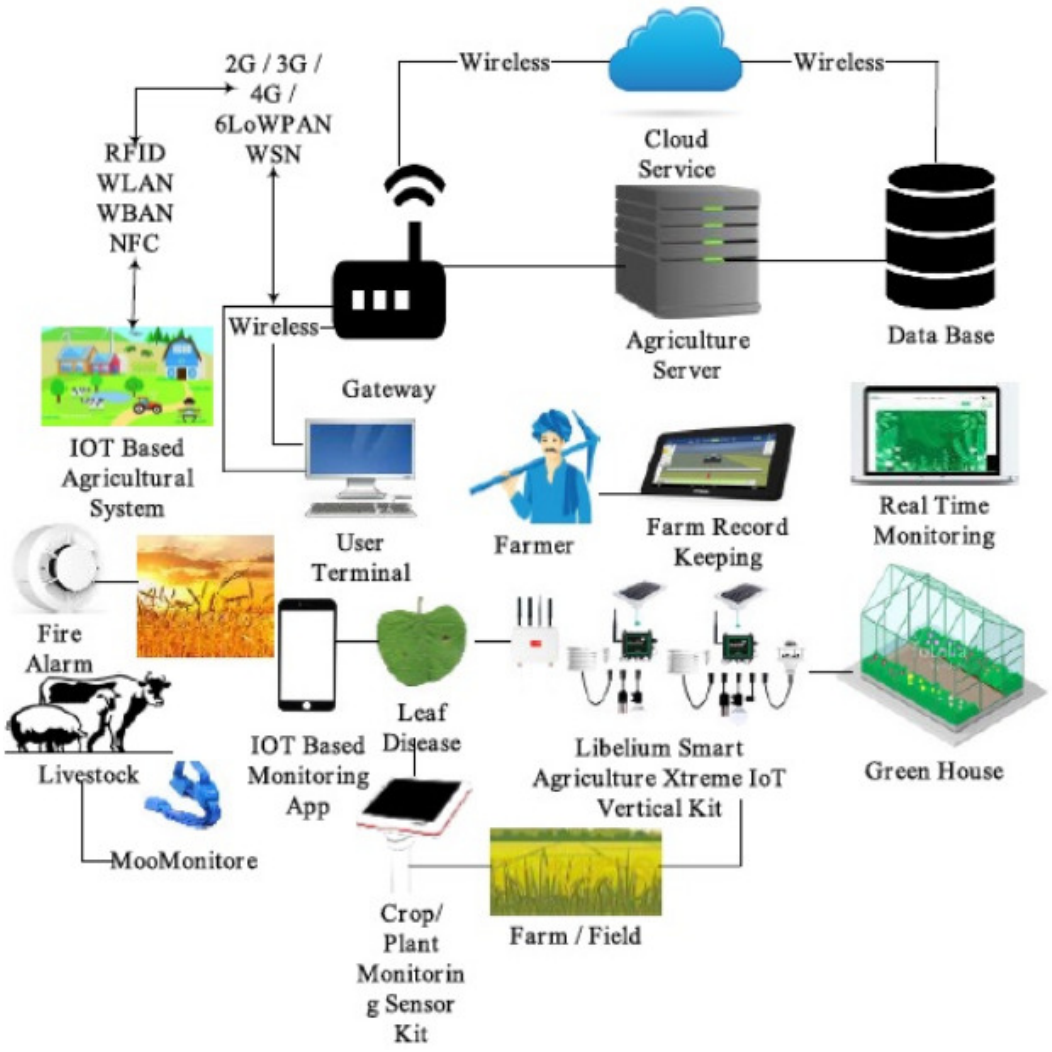
Source: TEKTELIC. (2024).

2.1. Definition and Components of IoT

1. Background In this subsection, a detailed definition of the Internet of Things (IoT) is provided, specifically focusing on its application in agriculture. It breaks down the key components of IoT, including sensors, connectivity, data processing, and user interface (Boursianis et al.2022). The section explains how these components interact to enable real-time monitoring and automation in farming practices. It also discusses the significance of each component in improving operational efficiency and resource management. By illustrating these elements, the subsection emphasizes the technological foundation necessary for effective smart farming (Javaid et al.2022). Additionally, it explores various IoT devices that may be used in agriculture, ranging from soil moisture sensors to climate monitoring systems. This explanation enhances the reader's understanding of the capabilities that IoT can bring to agriculture. The straightforward definition and description serve to clarify any misconceptions surrounding IoT technologies in farming. Smart farming is an innovative approach to sustainable agriculture based on Information and Communication Technologies (ICT), especially the Internet of Things (IoT) (Dhanaraju et al.2022). The conventional agricultural practices can be integrated with IoT to enhance efficiency, productivity, profitability, and sustainability. IoT is a core technology behind the smart ecosystems that would connect smart industries of the future. Thus, IoT can be viewed as network systems consisting of essential components, such as sensors or devices that are spread over large geographic areas to collect real-time data or measurements (Singh et al., 2021). The IoT devices are further connected to the Internet to share the data with stakeholders or application software platforms. Therefore, the IoT sends the data to the cloud or to other connected devices, where the data is processed, stored, managed, and visualized. Thus, IoT services are characterized by four main components: devices or sensors, connectivity, data processing or analysis, and user interface (Gupta and Quamara2020). Sustainable agriculture is a global field that faces immense challenges. A range of IoT devices can be used to improve, automate, or optimize agricultural practices. Each IoT device might capture different types of data or serve different purposes. For example, IoT can capture soil moisture, temperature, acidity, or even electrical conductivity across a vast area (Kassim, 2020). Additionally, IoT devices may capture climate conditions, such as wind direction, ground or cloud temperatures, humidity, rainfall, UV radiation, nitrogen oxides, acid rain, ozone, and carbon monoxide, and provide a warning for imminent danger, see Figure 2. They may even monitor animal health and welfare. There are already numerous applications of IoT devices in agriculture,

with new technologies being developed and integrated into the agricultural sector. It is important to define the IoT, for there are some misconceptions around its features (Liang and Shah, 2023).

Figure 2: The Smart Farming Trends



Source: Mahbub, M. (2020).

At the field level, sensor networks collect and transmit data about the environmental conditions, soil, or crop physiology that is then processed offsite by connected hardware and software to create recommendations that are sent to clients by mobile phones and other handheld computers. These technologies are at the forefront of agriculture's digital revolution. By doing so,

stakeholders can obtain real-time information about the agro-ecosystems (Sanjeevi et al.2020). The technologies do not use the cloud, mobile apps, or wireless internet services. Though IoT makes use of the cloud, wireless communication, and other web/internet technologies, it can work offline and can be implemented without the Internet. Devices are normally implemented in collecting data. Each one of them can measure a certain parameter related to the system operated. They can simply sense data from what surrounds or interacts with them and send this data into another system for subsequent automatic decision-making, taking feedback, or the ability to automatically control (Mouha, 2021).

2.2. Benefits and Challenges of IoT Adoption in Agriculture

2.2.1. Benefits of IoT Adoption in Agriculture Interest in IoT applications in farming is due to the wide range of potential benefits for the farming sector across the world and at different scales of farming practices (Kim et al., 2020). IoT systems often translate farm data both in real-time and not to information that connects farming activities and management to improve value chains in terms of food security, optimizing human labor, and conserving resources. As a guiding principle, IoT applications in farming can increase efficiency and production to maintain and/or increase yields; reduce costs by improving information use and resource management; and decrease environmental impacts (Dhanaraju et al.2022). For efficiency improvements, IoT and data analytics can allocate agricultural inputs such as irrigation, fertilizer, or feed to precisely meet their requirements, and monitor livestock or crops to more accurately detect diseases, pests, nutrition, and stress conditions, weather, and soil (Dhanaraju et al.2022).

However, until now, the widespread adoption of IoT in agriculture has been modest. There are a number of reasons for this, many of which were identified in the agri-food community and are linked with the adoption of new technologies and change (Sinha & Dhanalakshmi, 2022). This includes reluctance from farmers to leave their comfort zones due to a fear of the unknown and a desire to avoid risk. Because some IoT solutions require a sizable up-front investment, they may be the thing that breaks an already shaky bank and land the farmer in financial ruin. The adoption of IoT technology is not without challenges (Nižetić et al.2020). These challenges include the cost of the IoT devices, the lack of digital skills, data privacy, and the lack of IoT expertise, which is considered one of the most critical challenges. Several months of technical skills training and support are provided to new IoT users during the pilot training to support them in becoming

familiar with the new system (Idoje et al., 2021). Data privacy and ownership are two significant concerns for producers when it comes to the use of any precision agriculture technology, including IoT. Data that has been accurately captured and interpreted does not belong only to the farmer/user; it can be used in other commercial ways, such as helping develop new products. In the context of precision agriculture, management support services may use the data that IoT applications have collected from and about farmers for a range of purposes that includes farmer support, but also supported market analysis, decision-making applications, new service development, and even entrepreneurial farming (Chanal & Kakkasageri, 2020). The most significant barriers faced in adopting digital technologies came from the technical category (i.e., lack of knowledge and competencies and lack of infrastructure), followed by attitudinal and financial barriers (Ullah et al.2021).

3. Smart Farm Management Systems

Smart farm management systems have made a revolution by integrating Internet of Things technologies in farming to optimize agricultural processes. These systems are comprised of different technologies to manage a farm by developing several modern techniques and marketing strategies, which makes it possible to optimize farming parameters, maximize yields, and maintain crop quality (Boursianis et al.2022). A smart farm management system consists of several components, such as a control center with monitoring ability, automation systems, a decision support system, a data analytics platform, and a mobile application for farmers (Mahbub, 2020). Automation tools are the main part of a smart farm application system, which includes numerous agricultural applications like precision agriculture, natural resource management, dairy farm systems, aquaculture systems, and more. Data analytics platforms are software that can help farmers easily use these vast amounts of information to make informed decisions, while mobile applications make managing the day-to-day aspects of farming more efficient and coordinated (Javaid et al.2022).

Many different methodologies have been developed for smart farming, which can be used to develop systems taking into account different sections, such as natural resources, analysis mechanisms, and the scale of the environment. Natural resources-based smart farming systems rely on the information acquired from the arrangement of sensors and provide information such as soil conditions, weather, weeds, and pests (Chukkapalli et al.2020). These systems can also be used to reduce environmental emissions into the atmosphere, energy usage, and increase product

yields. For example, some types of data like wetting schedule, use of water, growth density, relative humidity, and soil moisture are collected by using sensors and an automated irrigation system to enhance the productivity of cucumber cultivation with chemical fertilization in greenhouses. In a managed environment, such as greenhouses, flowering date and time of inner-plot soil temperature is an important variable that affects the rooting time (Sovacool et al.2021). The better the rooting time, the more it will improve the rooting percentage. Horticultural robots with sensors and software, as well as automated systems, are able to support the management of these parameters to enhance productivity and improve the quality of crops in greenhouses and storage facilities (Singh et al.2022).

3.1. Key Components and Technologies

Increased implementation of advanced farm machinery and ICT systems has resulted in a range of new tools being made available to farmers and farm managers. These include machine and crop sensors, drones, field robots, and satellite imagery (Danda, 2024). Information derived from these technology implementations and other data sources is processed and analyzed using one or more computers running appropriate algorithms and agronomic models. Information on recommended actions or prescription maps, relevant for the management of the particular farm attribute, is then generated and delivered to the appropriate location and deployed either on-board a machine or tractor or conveyed separately, for example, by a mobile phone or computer, to an operator, contractor, or cropping advisor (Rehman et al.2022). These tools generally fall into the broader categories of:

* Sensors: on-board machinery, crop, environment
* Drones: aircraft fitted with multi-spectral/RGB cameras for field inspection
* Field robotic vehicles: used for compact sections of the farm for a variety of tasks
* Satellite heritage: satellite images are developed at different spatial resolutions and in different frequency bands, particularly useful for broad-scale farm infrastructure, soil zone types, and boundaries
* Computer-based machinery guidance systems and software: for planning, management, and survey of farm activities (Kucharczyk & Hugenholtz, 2021)(Hussein et al.2021)(Yeong et al., 2021). Implementation of these systems is changing the landscape of agriculture, ensuring precision agriculture outcomes. Many of these tools are employed to provide real-time in-season recommendations. The benefits of 'real-time' advice have been well established in scientific

literature and the Australian cropping context (Hamid et al.2021). For inputs, the ability to apply deficit or surplus applications of plant protective products, such as fertilizer, chemicals, and water, results in a high likelihood of profit. This also reduces risks of environmental pollution. Many of these in-crop sensors and related tools are used in variable rate farming based on relevant prescription maps (Chivenge et al.2022).

3.2. Integration of IoT in Farming Operations

IoT is influencing the agricultural domain, particularly in improving farming operations at various development levels. Practical integration of IoT is depicted in the literature, including diverse devices designed to function efficiently in large-scale farming operations. This incorporates stock control such as cattle, water systems, and energy consumption (Boursianis et al.2022). The provision of advanced irrigation from the Lolayetta lands network aligns with this line of thinking. Furthermore, other monitoring applications have been developed for precision agriculture. The decision support system for monitoring soil moisture levels, pH, as well as electric conductivity, weather conditions, air temperature, humidity, onset of rain, wind direction, speed, and rainfall has been developed for the WIC-EO multi-connector (Zhai et al.2020). The RHT sensor was designed using a microcontroller and connected to the Internet via Wi-Fi and web data management (Santos et al.2023).

The LoRa protocol, which collects and analyzes real-time temperature, humidity, water conditions, and others with a wide range of TSRs, is also used to monitor water quality in aquaculture. Numerous applications employing IoT have been presented to efficiently manage different crops, including horticultural plants and grains (Sendra et al.2023). Diverse devices are used, including sensors connected to the Internet via wireless technologies capable of transmitting live data to producers and managers. Recently, vegetable farmers in the villages engaged in the project, adopting various IoT technologies targeting the improvement of crop productivity. Integrated designs that encompass off-the-shelf wireless sensors can be used to monitor variables within farms, such as soil moisture content and saline water availability, gate operation, and vehicles or people counting have also been reported. The sensors communicate with the established LoRa network, and data are consolidated on a cloud-based management system for user access. Environmental data imports to the management system and services alarms based on predefined threshold values (Dhanaraju et al.2022). Farmers can access this real-time data from anywhere using the Internet through their mobile devices, iPad, or computer. Organizing the real-

time data and information in an easy way to understand for the end user was a driving goal in the design of the system (Liang and Shah2023).

Furthermore, three types of low-cost sensors are employed and strategically installed at the farms in flexible designs based on their needs. By doing so, farmers can deploy a tailored approach to the management of crop consignment with immediate reactions to environmental influences. Other activities of farmers to handle their farms, such as analyzing the weather, soil, and other conditions to make decisions and take actions, have been made very simple by the developed management system (Soussi et al., 2024). Comprehensive information that relates to the likelihood of farm planning and human error minimization can be employed with the analytic report. Additionally, it was argued that wireless irrigation sensor data integration with wireless soil sensors from other companies was undertaken, but only offered weather stations. Further demonstrations showed how a seamless Bluetooth-integrated digital flow meter continuously measures meter connection quality, wireless, and data availability while irrigating a field (Ambildhuke and Banik2022). Emerging issues in agricultural technology are revealing that water-use efficiency does not strictly relate to measuring soil or plant moisture. However, it was reported that by integrating the flow meter data with weather stations and SAR-based evapotranspiration estimates, farmers examine real-time information and make proactive decisions (Liang and Shah2023).

4. Case Studies of IoT Adoption in Agriculture

4. Case Studies of IoT Adoption in Agriculture: This initial case study on IoT in Egypt showcases the use of low-cost data validation devices and ZigBee sensors in open-field agriculture to collect climate, soil, and leaf wetness data that are sent to data visualization dashboards (Yin et al., 2021). These have been in use since the late 1990s to help farmers in Galicia better manage grape production. In the sheep sector, commercial lambs are known to have different feed efficiencies; identifying and classifying that feed conversion, especially on intensive diets, has been problematic (Ellison et al.2022). IoT devices in all the examples discussed are low cost, and indeed the combined technical and electronic components typically do not amount to over 30%. A smart farm package has been unveiled for Australian broadacre farmers to optimize worker and machine efficiency through enhanced communication and decision-making on the farm (Newton et al., 2020). A project utilized an IoT platform to couple high-accuracy analytics, automation, machinery, and biological data to deliver real-time recommendations to producers, especially targeted around adverse events (Rane et al.2024).

In the UK, a project designed to integrate best practices has been growing and is now called FieldBazaar. A follow-up discussion covers the practical application of such technologies and provides case studies of IoT in agriculture. Three of the case studies involve viticulture, and two are in Pakistan and Iraq, with the rest as far afield as Colombia (Alhasan et al.2022). Providing nine case studies from different world regions adds depth to the understanding of challenges and variations in types of produce and technologies (Bereczki & Kárpáti, 2021). IoT case studies in Iraq: platforms have been developing IoT applications worldwide in its application of precision and smart agriculture concepts and technologies. The Kurdistan Region of Iraq and the rest of Iraq depend on both public and private drinking water resources. Water use in agriculture is incredibly high in the Kurdistan Region and the rest of Iraq, whereby the SmartAgri-IoT can provide more pragmatic guidelines when it comes to water use and ensure that only the optimal irrigation amount and frequency are used in agricultural lands. It was found that Arab varieties receive advice via smartphone in the city of Missan, which helped farmers during the COVID-19 curfew (Tahir & Harun, 2022; Abdulrahman, 2020). There is a growing interest in lifestyle farming, with international farmers growing crops such as lavender and ostriches in the region. The SmartAgri-IoT can be utilized for such farms, whereby IoT devices can be used by mobile telecom operators (Zwarts et al., 2023).

4.1. Global Examples

Wheat and Dairy Farming in Alert Tasmania: Peter and Bev Vonarx operate a 2,000-hectare farm in north-west Tasmania, which is home to a herd of 1,000 pasture-raised cows. Weather is a major challenge in the region – dry summers, wind, and rain – extensive tracking of weather using a set of IoT sensors to develop land management practices and improve cow health (Neethirajan & Kemp, 2021). Irrigation and water application control also contribute to the overall improvement in farm performance. Data Stream Farming: Allan Giffard operates a 2,500-hectare property near Griffith in the New South Wales irrigated region (Abioye et al.2020). Mildura's main climate challenges are hot temperatures, wind, and the risk of frost. It is with this in mind that the farm uses a series of technologies that provide data streams, including remotely piloted aircraft, to undertake aspects of crop management such as water and nutrient application. Despite only very recently taking the farm up as an interoperable digital farm, the return from several projects substantiates the value of IoT technology from a farm sector worth A$921 million per annum. The transferability of the dairy and cropping sensor technology from Tasmania, Mildura, and

Goulburn, although linked to a related agricultural sector with similar off-farm requirements of quality assured producers, not forgetting the potential market value, would be significantly lower than that of the sensors in the wine industry. Compared with Chinese agriculture, which adopted almost the same number of IoT sensors, the technology solutions are better and therefore more expensive. Other Chinese agriculture technology has also proven to have poor on-farm uptake because the solutions were designed on an unrealistic model and were beyond the affordability of most farmers. Notwithstanding the systems across the world that display multiple sensors for weather prediction, evidence that purchasing a weather station in 2015 avoided a $700,000 loss in productivity, but also avoided the loss of 2,900 cattle as predicted by the model. Large percentage changes in on-farm decision making as a result of real-time weather data responsive tools. It is not only in large agriculture that the IoT has demonstrated ROI capability; clearly, in the wine sector, significant uptake has displayed that value. According to a single use case documented, a deployment of IoT has helped to deliver a $134,000 to $240,000 per annum increase in gross margin.

4.2. Iraq-specific Examples

4.2. Iraq-specific Examples. Despite the reported lack of studies, there are examples from Iraq showing that local farming communities are adopting and integrating IoT technologies to improve their farm and production systems. One example of using IoT in agricultural fields is to assess the crop yield associated with the production system (Allawi & Al-Jazaeri, 2023). Cucumber yield has significantly increased by 7–23% by using a sprinkler irrigation system. Although such an assessment does not cover the full stack and all environmental, social, and economic Agri-IoT aspects, it gives an idea of how using some technologies on the farm could enhance the productivity of a particular single plant. The more examples of using IoT in agriculture are not well published. This section presents successful implementation of IoT in agriculture to support more farm management and sustainability of agricultural processes (Cui et al., 2020).

The Ministry of Agriculture and Irrigation, in collaboration with the private sector, conducted some projects in terms of smart villages under precision agriculture in different cities of Iraq, such as Zurbatiya and Badra. The project contains the following characteristics: connecting devices and gathering information, including temperature, humidity, carbon monoxide, and other pollutants; controlling and managing agricultural production; managing the process of measuring fields and conducting analysis for all agricultural tests, such as the content of macronutrients, micronutrients,

and pH values; sharing data to make decisions; reducing water through precision irrigation, which helps in water management applications and measuring the conductivity of soil and agricultural irrigation practices. In addition, another project using IoT technologies was established in Najaf governorate, which consists of installing smart water meters in the city and in the villages (Ali and Ali2023). The purpose of these projects is to reduce the waste of drinking water, especially in this period when most of the populated cities in Iraq are subjected to a severe lack of water.

5. Implications for Sustainable Agriculture in Iraq

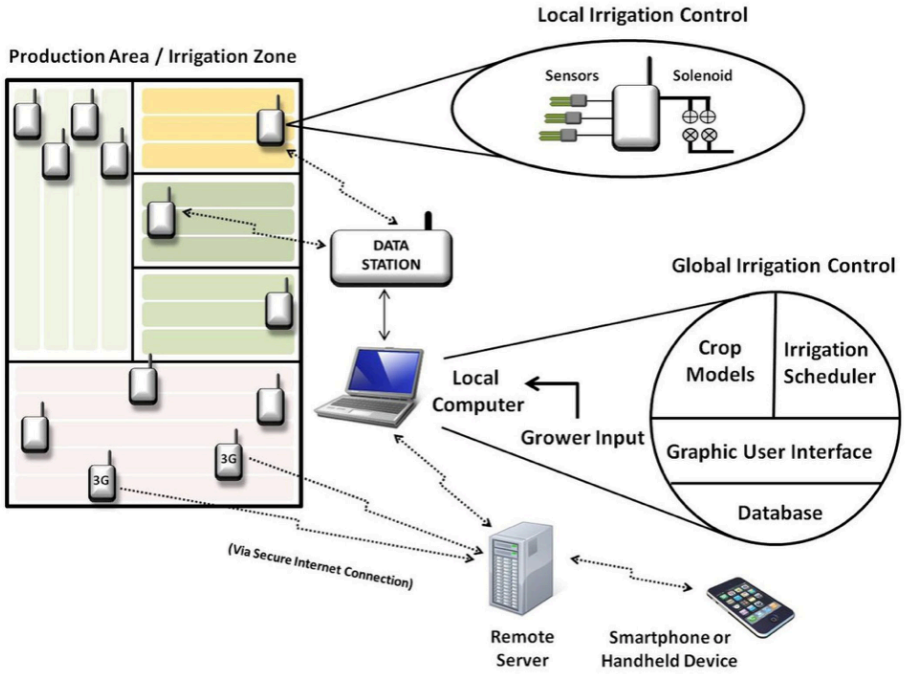
5.1 Improving Environmental Conditions

IoT technologies allow for sound and efficient natural resource management, which in turn produces less environmental degradation. Through big data collection and analysis, farmers can figure out the best solutions to protect the environment and natural resources (Akhigbe et al.2021). An IoT-based approach improves the environmental sustainability of agriculture since farmers can examine variables such as weather conditions and cultivation types. Therefore, it is possible to reduce human pressure on natural resources. For example, reducing pesticides through real-time disinsectization may improve contact between insects and biopesticides; this benefits the environment and is more sustainable over the long term (Haseeb et al., 2020).

5.2 Increasing Economic Growth

The adoption of IoT at any stage of the food chain can reduce costs significantly as in Figure 3. Improved costs and margins can be achieved by minimizing waste with better quality control, speeding up processes, and using resources more efficiently. The provisioning of collected data to all value chain parties results in reduced overall costs and increased profits per value chain actor (Aamer et al.2021). The increased awareness of all parties in the food chain ultimately results in higher overall income and improved livelihoods. Precision farming is considered to bolster conservation tillage and no-tillage methods that protect and save the most natural resources from degradation (Júnior et al.2024).

Figure 3: Smart Farming System: Sensor and Control Technologies for Enhanced Irrigation Efficiency and Sustainable Production



Source: Smart Farms Home (2024).

Farmers can save up to 20% of the costs of water, fertilizers, chemicals, and up to 10% of the fuel costs used in tractors. These figures translate into euros, just at the level of the company, in a savings range that varies between €50/ha and €85/ha/year, depending on the level of digital technology (Gathala et al.2020).

5.3 Cultural and Social Implications

Enhancing the culture of local farmers can be employed; it allows for regional identity and jungle livelihoods to be exposed. For instance, the emphasis on traditional seafaring, combined with fishing cultures, has consolidated prosperity, earning a place in Intangible Cultural Heritage. Some small-scale IoT technologies could, in the same way, validate the sustainable benefits related to mountain olive selection or fruit farming (Dhanaraju et al.2022). Convergent research is scarce because few measurements, procedures, or evaluation systems combine environmental, economic, and social dimensions. Focusing on the interactions between those three areas is regarded as an

innovative contribution to the evaluation of IoT technology in agriculture. Our research aims to evaluate the second era of IoT adoption and the use of technologies in terms of sustainability factors, effectiveness, and supervision (Raj et al.2021). Collecting data in the three analyzed areas, lower production costs are possible for the entire agri-food market, enhancing economic growth as a justified return on investment (Zhao et al., 2021).

6.1. Environmental Impact

6.1. - Environmental Impact

One facet of global concerns is the environmental impact of smart farming in terms of soil, water, nutrients, and ecosystems. Adoption of IoT in farming can ameliorate its environmental footprint. It can reduce waste related to overuse of resources, mitigate emissions obtained from resource wastefulness, optimize usage of farm inputs like seeds and fertilizers, reduce wastefulness, and minimize negative externalities (Lakhiar et al.2024). The main ecological impacts in farming are related to using clean water, soil nutrients, and land area to grow crops. Inefficient use has major repercussions on soil sustainability and the environment; reductions in resource usage can have positive effects. Freshwater withdrawals globally have more than doubled since World War II (Kaushal et al.2021).

Water conservation: Several environmental disadvantages can be diminished or prevented through IoT services for water reduction from IoT technologies. IoT services for farmers can provide detailed water requirements with respect to crop growth and can reveal excess moisture in soils. These can minimize damage due to over-watering, allow soil drying before harvest, and ensure crop yield potentials are not limited due to water logging. Enhanced soil quality: Imports from the application of IoT to smart farming contribute to the use of sustainable intensification practices in farming, which include reductions in soil chemical runoff, soil water holding, and nutrient supply (Tang et al.2021). Adoption of IoT usage in farming practice has significantly decreased soil nutrient and agricultural chemical runoff and wastage in potential fertilizers. IoT can provide a more precise history of feed uptake by crops, which in turn can give a precise indication of residual nutrients. This can reduce the amount of runoff from farm fields into water supply systems and can contribute to lessening water treatment costs. Policy requires the promotion of agricultural practices that contribute to sustainable farming and minimize water pollution from chemicals. Biodiversity: IoT usage practiced as part of cropping and farming systems in commercial agriculture has insufficiently been influenced to make observations about

environmental effects (Xia et al.2020). Those instances of land use types generally enhance the landscape's ecological function. For example, reduced tilling and use of permanent, internal grassed lands integrate with agendas for supporting soil conservation and enhancing wildlife habitat. Agricultural technology in the development of machinery and techniques used only in premium cropping enterprises does not incorporate any of these aspects into machinery specifications. Proposed practices have three primary environmental advantages: reduced residue trapping due to less intense tillage, minimized fertilizers and nutrient release, and minimized energy usage and emissions by farmers (Da et al.2021). Farmers using these practices are assumed to be offering some 'ecosystem services' to the broader community. Medium-term indicators of the success of sustainability ecosystem services depend on environmental factors. Calls will therefore only be able to express benefits on a case-by-case basis. Farmers are receiving machinery and system equipment in the expectation of issuers delivering a novel system with agricultural benefits (Tamburini et al.2020).

6.2. Economic Benefits

Does the adoption of IoT benefit farmers financially? Several studies have suggested that farmers do indeed experience significant cost reductions and efficiency gains through the adoption of IoT. This can occur when the use of IoT technology leads to (i) resource savings through the development of smart inputs that are used only as required; (ii) cost savings on inputs, labor, and energy; and (iii) increased yields. Potential savings and efficiencies include reducing water use by 25%, reducing fertilizer use and costs by 25%, reducing drinking water for dairy cows by 60%, and reducing the area devoted to chickpeas by 28%, while maintaining yields. All of these case studies have employed IoT technologies to do so (Raj et al.2021).

Empirical evidence supporting the farm-level benefits of IoT is provided in the case study literature. A survey of pumpkin growers found that IoT emitters reduced water costs by about 5%, with a 1% increase in crop yield. The respondents confirmed that IoT emitters are a good alternative for the application of precise irrigation systems, as they save time and space. The potential reduction in planting area via the use of the drip-irrigation system with IoT would increase farmer profit and, in turn, provide sustainable income for the farmers (Shabbir et al.2020). The linchpin of a zero farming approach is the cultivation of increasingly nutrient-rich, high-value crops using field-level IoT technologies like innovative internet-connected fish-feeding products that can optimize feeding post-harvest, drones, and surveillance systems to monitor crops, fish

feeding, water temperature, and salinity management software. The adoption of IoT in working farms underscores the potential for high yields and profits. Economies of scale may also be realized if successful IoT in working and innovative farms acts as a beacon to those beginning IoT adoption (Rajabzadeh & Fatorachian, 2023). The increase in local fish feed demand and production in supporting farmers' innovation contributes directly and indirectly to job creation. Each factor mentioned in the zero farming diagram contributes to solving major challenges in agriculture, contributing not just to food security but, by extension, to regional and country development. This is supported by development priorities and sustainable development goals for many countries, and consequently, the prioritization of investment in technologies and business models that facilitate transformation is necessary (Nasr-Allah et al.2020).

6.3. Social Implications

Opportunities. Integrating IoT technology into agriculture holds both promising opportunities for farmers and barriers to effective adoption. IoT technology can empower farmers by providing direct control over data flows within an intelligent digital environment. They can connect with various digital data services through the use of IoT to support and enhance their decision-making power, create efficiency, and produce sustainable output (Torky & Hassanein, 2020) As such, perhaps more importantly, a digitalization pathway geared towards smart management systems in the digital agricultural age will empower farmers in the socio-economic and techno-economic relationships representing the triple win for entrepreneurial savvy and future social welfare. For instance, the insights from the household survey show that the potential high precision technology calibrated through IoT-based data acquisition in paddies could be a tool to direct people living in relatively small-scale, marginal, and even farm-based livelihoods that require seasonal jobs in multiple occupation systems producing sufficient value at the end (Büyüközkan & Uztürk, 2024).

Challenges. The streamlined flow of real-time big data created as a result of these technologies has implications for both social and environmental systems. Farmers, particularly within marginal and farm-based livelihoods, face notable challenges that may limit their ability to adopt IoT technologies. One key challenge is the digital divide, where access to technology is not readily available or is cost-prohibitive (Sharma et al., 2022). This not only includes limitations in technology access and cost of use but also a lack of training and time to learn how to effectively integrate and use new technological resources within these systems. Several community-based initiatives aim to reduce and minimize the barriers that might limit the inclusivity and spread of

smart management technologies. Building trust and reducing resistance within communities is central to the development and acceptance of smart technologies. Within the data sphere, ensuring privacy with the accountability and verification of the identity and credibility of persons involved in controlling data runs as a common underlying principle. Ideally, data governance involves consent as the central mechanism for enabling data use (Alabdali et al., 2023).

As the role of technologies in agriculture transitions from primary production to data acquisition and integrative systems management, new skills will need to be developed to engage individuals and farmers. Community-based and farmer-to-farmer educational programs and demonstration assessments are therefore crucial for facilitating the uptake and adoption of these platforms. As development initiatives prompt large-scale change in land use and management practices, it is vital that the implications of such innovations, both beneficial and damaging, are projected into the future. When the implementation of smart farming faces social challenges, such as the question of access, trends of dis-adoption in the digitalization pathway can be expected (Stringer et al.2020). Agricultural digitalization must, therefore, be considered as an advanced technological pathway within a comprehensive systems approach drawing upon data innovation systems. This will necessarily consider the diversity of agro-ecosystem contexts, farmer identities, traditional pathways, and knowledge systems for shaping more desirable futures for tomorrow (Lajoie-O'Malley et al.2020).

7. Challenges and Future Directions

7.1. Barriers for the Adoption of IoT Technologies in Agriculture From an industry perspective, there are eight major potential barriers for the adoption of IoT technologies in agriculture: • High initial investment cost is a barrier; however, recent research shows that, in the long term, industrial actions result in profit. • No technical skills in IT, software development, and data analytics are a challenge. • Resistance towards the use of computers and smartphones is human-related resistance. • The technology has dispelled the rural community from traditional means. • Excessive misuse of social media among the population is also related to people disliking technology. • Data security is an issue due to data confidentiality and the people behind the system who are also at risk. • Technological illiteracy and the presence of generations who are unfamiliar with technology are a problem (Kumar et al.2022).

7.2. Future Directions Future directions in this field should be guided to produce a stand-alone IoT device, which is directly integrated with a traditional sensor. These devices work especially well in

maintaining greenhouses and gardens around the country in terms of watering scheduling and temperature control. Additionally, providing extensive information on cultivation by applying Internet of Things (IoT) technologies with an emphasis on production systems that hinge on agro-environment, IoT services for Integrated Pest Management, phytosanitary treatment of growing media, and addressing ash urns and bins in the cultivation environment is essential (Boursianis et al.2022). A comprehensive review of the literature needs to be conducted regarding IoT in agriculture, especially multifunctionality in agriculture, agri-environmental dimensions, consumer choices, behavioral modeling, and trade-off issues in the context of the adoption of Internet of Things applications in sustainable agriculture (Farooq et al., 2020).

Supported by collaborative actions between representatives of the government, IT developers, and experts in the field of agriculture, a vision should be developed to define the ambition from the technical side. Workshops should collect examples of the challenges in the field with verification cases (Mahdad et al.2022). Documentation of stakeholders' needs, challenges, and the way forward should be presented in a report with the intention to pave the way to the local Living Lab. Policymakers, business developers, and investors should explore what's next based on the report and benefit from the outcome of the work package in order to contribute to the development of the local Living Lab (Thees et al., 2020). Even though IoT adoption comes with great benefits, many challenges are still holding back the change in today’s smart farming. The trend of IoT adoption has yet to gain the attention of some governments in order to alter the policy framework in these countries. Therefore, it is important to educate unskilled farmers by establishing workshops that involve the workings of IT, software, and data analytics in terms of agricultural applications and related technologies, targeting the communities and media. As part of IoT technology trends, some key future directions might include ongoing core system development since current research is limited due to technological growth in IoT hardware and middleware. Research on middleware operations has been a lynchpin of today’s research because of its extensive applications, especially when utilized in smartphones in the region (Karunathilake et al., 2023). In the future, more research should be attempted on IoT data.

8. Conclusion and Recommendations

This article has shown that the adoption of IoT technologies has the potential to critically transform conventional farming practices in Iraq, leading to progress towards a strong, sustainable agricultural sector that can underpin economic and social empowerment. Nevertheless, challenges

including inadequate technological infrastructure, the high cost of IoT devices, and the uncertain future of advanced technologies have weakened the uptake rate of IoT in Iraq's agricultural sector. Overcoming these challenges requires not only the technological advancement of IoT devices and sensors, but also a strategic, systematic plan to manage the adoption of IoT in Iraq's agricultural practices. By encouraging this, traditional farmers are likely to find the incentive for adopting IoT in their agricultural activities, and tech companies are able to position them a step ahead in reforming the field of agricultural IoT devices. The adoption of IoT technologies is a cornerstone of various technological trends observed to shape the future of humanity in general, as well as the agricultural sector. These trends are expected to see agricultural practices keep up with the increasing world population and to explore an answer to the triggers of climate change and new diseases that affect plants and animals (Hussein et al.2024). Iraq is one of the countries with a long history in agriculture and has the resources of water, tillable lands, and a good climate, and so it is quite fit for a rapid advancement towards scientific agriculture and sustainable livelihood. The global participation in these scientific trends has not been taken by Iraq; this lack of attention and participation in newly developed technologies, along with the absence of human understanding and knowledge, has made Iraq import agricultural products worth US $6.8 billion from different countries around the world, approximately 75 percent of the country's self-sufficiency requirement. To all stakeholders, a recommendation is required to develop farms, farmers, and those involved in developing software and related applications; they must participate in workshops, conferences, and lectures to exchange ideas and information among themselves. Such business-community boards will help to identify certain problematic areas and develop potential projects of interest to farmers to use IoT technology in Iraq (Wang, 2022). Policymakers need to do more to increase the trust in high-quality IoT devices and to hold talks with various countries to sign technology cooperation agreements.

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6. Conclusions

Creating an agricultural Growth strategy requires a focus on priorities 'most binding constraints', the general rule of reform in developing and transition countries; a plan will fail if it aims to address every issue at one time. Instead, it should concentrate on the changes most likely to initiate growth in the rural economy.

Reform is a primary focus of political literature in Iraq today. Yet, most research focuses on points that are not fundamental obstacles or some research focuses on the comprehensive reform process, which is good in theory but drains all energies and resources before the plan is finally implemented. The growth diagnosis approach focuses on only the most binding constraints, which is fruitful when it comes to searching for reform efforts aimed at enhancing growth rather than those that involve the global sector and its resources and energies. Today, Iraqi agriculture faces difficulties in several areas, such as infrastructure, lack of technology, and legislation related to ownership, insurance, customs, and fees. There are political obstacles, as Iraq faces political challenges, including external interference, corruption, bureaucracy, weak and poorly implemented legislation in import and consumer protection, and ineffective customs tariffs. This research includes a set of intervention methods and recommendations for each obstacle diagnosed and that the Iraqi agricultural sector suffers from practically and more realistically.

Having identified some of the most pressing challenges and reform needs in the agricultural sector in Iraq, we can now review the debate over reform between the growth diagnosis and the Washington Consensus from two perspectives. First, Iraq does not have the administrative, technical and financial capacity to plan and implement a comprehensive reform program to deal with such a variety of agricultural reform requirements simultaneously. Second, the political system in Iraq is difficult to have the stability needed to manage governance processes and conflicts resulting from comprehensive restructuring and reallocation of administrative and financial resources. Almost all reform programs adopted by the Iraqi government as well as international development organizations and agencies

in the nearly two decades since 2003 have been frustrated by two factors: the first factor is the poor technical and administrative performance of Iraqi administrations; and the second factor is the reluctance of qualified foreign personnel to face security risks and other location disadvantages by participating in those programs.

In all chapters, the study focused on legislation that attracts investment, improves performance in protecting products, and finds appropriate solutions through political and legal frameworks for a sustainable growth environment. Instead of focusing on large spending in the next phase, efforts should be directed towards legislative reforms that enhance the economic environment and support sustainable development, with implementation divided into phases. On the other hand, a comprehensive increase in public spending on agriculture is difficult to implement financially due to the financial bottlenecks that Iraq is constantly suffering from due to the volatility of oil prices and the increase in government consumption expenditures. The agricultural sector has also become a consumer sector, as the government always allocates large funds for reforms and building some facilities, but these funds quickly go without recording any improvement in performance. The agricultural sector in recent years has often started to consume what other sectors produce without recording good development facts.

Experiences from many countries indicate that political and legislative support for agriculture can lead to unprecedented rural and agricultural progress, making agriculture sustainable, providing stability and prosperity, and increasing farmers' incomes. In this context, agricultural policies, strategies, and development programs consist of laws, regulations, decisions, and directives that represent the legal framework for implementing and managing economic activities. These laws include land, budget, import and export, seeds and plants, and many laws related to agriculture and the economy. The previous review of the factors affecting growth in the agricultural sector has highlighted several issues, including infrastructure, dumping of goods, property rights, market regulation and contracts, lack of technology and methods of remediation, fragmentation of land into small holdings, and challenges of property rights. All of these problems are legislative in nature and can be addressed through careful consideration of the underlying issues. Thus, we can help the agricultural sector recover without the need for large sums of money

because public spending on agriculture, as we mentioned above, is not necessarily the key to a thriving, productive and sustainable sector. Therefore, starting with legislative agricultural sector reforms for all identified restrictions is probably the most appropriate topic to start a promising reform process in Iraqi agriculture, because it provides a wide range of intervention options, which would meet the above-mentioned criteria in terms of high and rapid impact, political feasibility, and financial capacity.

The first Chapter highlights the infrastructure in the medium and short run; the considerable damage to Iraqi agriculture caused by ISIS is a particularly serious challenge for farmers, agro-businesses, sector administration, and the government. Over the course of the wars and occupation of areas in northern Iraq, ISIS looted crops and agricultural equipment, destroyed the infrastructure of those areas, polluted the lands with oil, and cut down hundreds of hectares of trees as a form of collective punishment. It used tools of displacement and killing against religious minorities such as the Yazidis. To ensure the success of the rehabilitation plans for the agricultural sector infrastructure in Iraq, especially in the affected northern regions, proposals that would revive this sector should be followed up. Agricultural training centers should be established for the centers and emergency financial and technical support should be provided with the help of international organizations. Establishing monitoring mechanisms to evaluate the events and rehabilitation programs contributes to providing a picture of the development situation and facilitates measuring future production. Already, there are some associations when dedicated to training began, gave good indicators after years of training. Educational attainment has led to an increase in production capacity, which in turn can enhance the financial capabilities of women in particular, including rights to resources and the acquisition of new skills and resources to perform livelihood functions. Among the recommendations in this chapter were legislation to rebuild the infrastructure with the help of the private sector by offering direct investment, as well as the help of international organizations that are also trying to provide some kind of support to revive these areas.

The second Chapter focuses on issuing legislation regulating the process of foreign trade in agricultural commodities with the aim of protecting the local

market from dumping imported goods, which contributes to supporting local producers, reducing unemployment, and encouraging local agricultural projects. It is one of the rare undisputed wisdoms of economic theory that market-obstructing policies have to be abolished in order to enhance private investment and entrepreneurship in any economy. The identification of the 'most binding constraints' among those policies might be an easy task in developed market economies with limited cases of distortions emerging from time to time. In the case of Iraq, displaying a complex network of government interventions and administered prices in markets, such an attempt faces quasi-unsurmountable methodological and empirical challenges. In this respect, the Coronavirus disease 2019 (COVID-19) was greatly helpful for this study as its impact on the Iraqi agriculture displayed strong evidence of the most binding constraint in the Iraqi agriculture that can be alleviated without much political and financial challenges.

The Coalition Provisional Authority (CPA), abolished 2003 all custom tariffs on Iraqi imports and imposed instead a reconstruction levy of 5 percent on all imports into the country. This quasi-free trade regime continued more than one decade as from 2014 on Iraqi governments were politically capable to introduce moderate import tariffs on agricultural products. These have been, however, far from enough to protect Iraqi farmers against agricultural imports from Iran, Jordan and Turkey at dumping prices, and mostly not subject to customs control due to widespread smuggling and corrupt practices of some customs administrations. Not surprisingly, the National Development Plan 2018-2022 listed under the heading 'Agricultural development challenges' at the third place: Inadequate regulation and oversight of border entry points resulted in heightened illegal competition between imported agricultural crops and local produce. There is no doubt that Agricultural Trade Policy is the main responsible for the degrading in the agricultural sector in Iraq.

Allowing foreign agricultural goods to enter the Iraqi market without restrictions or control has adverse effects on the future of agricultural production. Over time, more producers exit the market and with the continuation of this restriction, the number of producers decreases. Therefore, decision-makers must prevent imports, especially for agricultural goods that the Iraqi producer can produce. Strict

protectionist policies must be imposed using available tools such as customs tariffs and others on imported foreign goods, especially those goods that are imported in large quantities and at low prices. Technical restrictions, measurement and quality control, and health policies must also be imposed. A body must be established to monitor the performance of protectionist policies and periodically evaluate the measures taken and their impact. The main goal is to establish a mechanism or program responsible for monitoring and interacting with global economic structures and partners, considering the priorities and interests of the Iraqi market.

The third Chapter discusses the importance of legislating contract farming laws that ensure fair partnerships between farmers and companies, in addition to encouraging local and foreign investments in this sector to enhance productivity and economic stability. It is a contracting process between producers on the one hand and sponsoring institutions or companies on the other hand to produce and supply agricultural products agreed upon in advance between the two parties, and usually the quality, quantity, type, inputs, prices and dates are agreed upon. Contract farming has many advantages, such as relative price stability, reduced dependence of producers on loans and fair prices, improved production capacities, direct marketing and the introduction of technology. The Iraqi agricultural sector is in dire need of all these advantages, as the sponsor of the production will be the contracting company, which provides consultations to producers on the quality and form of the product according to market requirements. Because usually contracting companies provide, among the inputs, extensive research and studies of the required product, which is what the producer ultimately benefits from by implementing the plan. This is one of the most prominent advantages that farmers need greatly.

This research recommends that legislators enact laws that regulate the work of contracts between producers and beneficiaries with laws that are fair to both parties and facilitate administrative procedures. As well as opening the field to graduates and granting them agricultural land plots and integrating them into production by providing agricultural land and good contracting companies. Additionally, implementation of contract farming regarding the improvement of the regulatory environment, capacity building, development of a clear contract enforcement

mechanism, research and development services in generating and transferring new technology, good policy, and coordination in agricultural sectors. The development of legislation and strategies on farm contract agricultural policy is essential. The legislative framework of contract farming in Iraq has to refer to the proper amendments to be made to the regulations governing the distribution of land, considering that farmers must work the land to show its value. The need for the reconstruction and development of the Iraqi economic agricultural policy is based on the strength of the right to participate, accountability, and transparency, grounded in sound, clear policies that serve the public interest of the Iraqi population as a whole. Farmers lack the knowledge and capital that would allow them to bring order to production. The market is guaranteed, and their participation in partnerships within the field of agribusiness across various occupations is necessary. They need training in specialized technical and business management that will enable them to manage and control any part of the agricultural crop. The introduction of new technology and capacity in various areas and aspects of the agricultural sector has not reached the required level, which would maintain the competitive position needed at the global level. Therefore, the agriculture sector must increase the ability of products and quality and improve efficiency, which could affect the productivity of the sector. Not benefiting from agricultural training in the fields of complex technology means the possibility of agribusiness withdrawing from the market, affecting the products they purchase and producing food without any impact or harm to customers.

The fourth Chapter tries to adopt modern technologies in agriculture, giving the ability to produce more efficiently, increase yields, make good use of inputs, and reduce costs, which leads to progress toward a sustainable agricultural sector. However, there are major challenges facing the application of these technologies, including high costs, trained people, and modern infrastructure. To overcome these challenges, a methodology and strategy are required to adopt these technologies in agricultural practices. In order for the agricultural sector to catch up with development, modern technologies must be considered in increasing yields in terms of using inputs more efficiently in order to achieve an increase in yield to meet the market needs for the growing population. Considering sustainability, not polluting

the environment, and producing to a reasonable extent that does not cause the soil to be consumed, sickened, its efficiency to decrease, and it stops producing.

This paper recommended that the road is open for adopting modern technologies, but on the condition that decision-makers help develop legislation that would help technology service companies contract with producers transparently and with guarantees for all parties. Decision-makers should also develop projects to train producers on modern technologies, such as applications for detecting plant and animal diseases, drip irrigation applications, vaccination schedule applications, and others. Decision-makers should also study the possibility of supporting the prices of devices and technical applications provided to producers. Finally, decision-makers should support infrastructure such as internet service, electricity, and devices that help build an integrated system for adopting the Internet of Things project in Iraqi agriculture.

Appendix 1 focuses on addressing the problem of fragmentation of agricultural lands by increasing investments and exploiting cultural assets such as the waqf system, which can be an effective tool for unifying agricultural lands and enhancing their productivity. The term waqf means to preserve or contain. It refers to a religious waqf where an asset, such as property or agricultural land, is donated for social, religious purposes, or general charitable, while ensuring that the benefits are used for the benefit of the community to which they are allocated on a permanent basis, believers have historically invented this formula to draw closer to God by participating in building their communities and populating the earth. The waqf is everlasting because it is an asset such as agricultural land, a water well, a school, or any charitable organisation, and in greatest cases, it is dynamic, generates money, and gives job opportunities. However, private estate can be a waqf, provided that proprietorship is relinquished for the waqf, and it must be for charitable purposes.

The need to meet market demands and economic development while considering environmental conservation and sustainability requires the creation of new ideas related to increasing yields and improving the quality of production. This comes from protecting the land from fragmentation. To achieve economic stability and food security in Islamic states and unify their cultivated lands, this research

combines legal outlines and community contributions to achieve the aim. The flexibility of the formulation of the Waqf law and its adaptation to the administrative system allows the donor to propose the form of the administrative structure so that the Waqf can act as an economic nucleus that supports sustainable development.

Decision-makers should facilitate the laws for establishing endowments and establish an authority that regulates all legal, social, and economic endowment activities. Also, laws should be enacted to help establish companies that combine agricultural cooperative models with the principles of waqf, which would address the fragmentation of farm holdings by consolidating fragmented plots of land while granting farmers ownership through contributions. Even when land is transferred as gifts to individuals, it ensures the protection of individual rights while simultaneously preserving the integrity and unity of the land (i.e., the transfer of ownership is through documents and not physical division, and it is disposed of again, and its type is changed to industrial land, for example). These companies can enhance cooperative farming practices, share resources, and improve market opportunities. By taking advantage of the cultural depth of the Islamic region and integrating it with modern cooperative strategies, this research offers a progressive solution to land fragmentation. It addresses economic and social problems in sustainable ways.

Finally, appendix 2 addresses the comparative case study reviewed the land ownership systems in rural areas in two countries, Iraq and Albania. It reconnoitered historical and current land issues in each country where either bottom-up approaches were pursued to address these issues. The paper draws conclusions and provides recommendations based on the comparative analysis of land tenure reforms in rural areas in Iraq and Albania. Both case studies have shown that, for land tenure reforms to be effective, policies must be based on a solid historical understanding of the communities in question. This study visited a couple of themes in discussing land issues. The first theme was the need to review the current land tenure system adopted in Iraq. The second theme discussed in the paper was the comparison of land issues and land tenure, between Albania and in

Iraq and how Albania has been relatively successful in its property reforms and attempts to integrate into the European market by applying EU standards.

Albania and Iraq have almost the same historical contexts, like Islamic background, Ottoman occupation, communist system, and then the transition to the free market; the paper aimed at looking at lessons learned from Albania and attempts at improving land ownership in Iraq. Numerous lessons can be learned for improving future land reforms, as many of the actions there have been quite successful. Some recommendations can be offered, which future policymakers pursuing land tenure security and equity should bear in mind. The study recommends that Iraq focus on; Strengthening the legal framework for land ownership to be more inclusive and transparent. Activate the GPS land identification program to have more accurate borders and avoid disputes. Adopting a digital land registration system to reduce disputes. Establishing specialized courts for land disputes to ensure justice and timely resolution.

The poor governance structures, weak public institutions and market-obstructing policies are the main generators of most of the resource and technology related constraints to agricultural growth in Iraq. In contrast to the poor utilization of natural resources and technology in today's agriculture, Iraq has a considerable endowment with resources and its population has proved in 1970s and 1980s the capacity to adopt to and to cope with challenges of technological change. Agricultural land, water resources, and climatic conditions offer the potential for substantial agricultural growth if combined with appropriate technology and management and if freed from policy-related constraints and replaced with correct and well-studied legislation. Vast parts of agricultural land are not utilized today and offer a great potential for production if adequately developed. In the same token, the large water resources of Euphrates, Tigris and other rivers in addition to rain and ground water reserves are much promising factors for agricultural growth if developed and managed according to modern techniques and augmented with proper irrigation systems. Climatic conditions offer an appreciable environment for production of a diversity of crops that is seldom attainable in other countries in the region. Iraq's high yield gaps in comparison to countries with similar climate and natural resources in the region and elsewhere are an indicator for the considerable

potential for attaining productivity gains. The rapid growth of the population offers a young labor force for the economic development in general and agricultural growth in particular. As a country with large energy resources and as one of the leading players in the world energy markets, Iraq also offers a high potential to cover the financial requirements of future investments for agricultural growth. To the extent that Iraq rebuilds its irrigation networks, energy and transport infrastructures, and fosters its agricultural logistics and research extension facilities, it will also enhance the comparative advantages of the agricultural sector thus enabling it to integrate into global value-chains and to promote export in distant markets in Europe and Central Asia. In the long run, the domestic agro-processing sector may create the potential to foster its competitiveness and to become an export sector importing raw materials.

By the same token, the demand conditions offer a high potential for sustained agricultural growth in Iraq. The domestic market, with a population close to 42.9 million and growing at a rate of 2.3%, offers ample room for agricultural growth. Considering the rather high - although fluctuating - per capita income and the trend to a growing consumer base with new middle-class consumption habits, it is reasonable to expect that there is an excellent potential for the dietary transition from staple grains into more high-value foods, for example, vegetables, fresh fruits, dairy foodstuffs and meat. The agricultural sector also offers the potential for value-added growth through processing fresh fruits, vegetables, and cereals as raw materials to produce a wide range of processed products. Iraq is far from self-sufficiency in agricultural products and is heavily dependent on the import of grains and other commodities. Thus, there is an excellent scope for the growth of the agricultural sector via import substitution. With suitable import policies in the short run and productivity gains in the medium and long run, domestic production can substitute a large share of imported grains, especially wheat, and other food commodities such as livestock, vegetables, and fruits from neighbouring countries.

Returning to the research question which was: What are the primary factors contributing to the weak growth of Iraq's agricultural sector, and how can these challenges be mitigated to enhance productivity and economic contribution?

Through the previous four chapters and the two appendices, the research studied in depth the reasons for the weakness of the agricultural sector, which included infrastructure, trade policies, weak legal frameworks that would regulate marketing operations, lack of human resources trained in modern technologies, and the impact of conflicts. The study presented recommendations for the advancement of this important sector for employment, income, and food security, a set of recommendations to improve productivity. This is the direct correct answer to the central question of this study.

The thesis presents a comprehensive analysis of the most pressing constraints limiting the growth of the Iraqi agricultural sector, through the four preceding chapters and two appendices. Each chapter or appendix highlights and addresses a key aspect of the agricultural sector, starting with the impact of territorial disputes and the collapse of infrastructure, then addressing the problems of commodity dumping and the ineffectiveness of trade regulation laws, contract farming laws and the benefits of their implementation, and concluding with the importance of investment strategies and agricultural technology. The thesis is reinforced by two appendices: the first on the application of the concept of Islamic endowment to reduce fragmentation of agricultural land and increase production, and the second appendix addresses the issue of property disputes, drawing on other experiences and adapting them to the Iraqi context. Applying the findings of this thesis on the ground will facilitate the adoption of modern agricultural policies that are in line with Iraq's economic and social conditions, the development of government programs that support agricultural rehabilitation, the provision of incentives to investors, and the strengthening of public-private partnerships. Furthermore, developing strategic plans to develop the agricultural sector by exploiting advanced technology, regulating local markets, and activating farmer support systems will contribute to achieving a true agricultural renaissance in Iraq. Therefore, this thesis provides an integrated framework for decision-makers and researchers to understand agricultural challenges and develop effective strategies to achieve sustainable agricultural development. Efficiently addresses the most pressing constraints to growth in Iraqi agriculture and investment barriers in this sector.

The limitation of this dissertation is primary; the study might prioritize agricultural production and exclude agro-industrial activities such as food processing or value chain analyses, often treated as separate economic sectors. The relationship between agriculture and industry is almost a so-called co-evolution of historical development. In conjunction with this trend, since the beginning of the 1960s, with the world's growing population and population increase, a so-called green revolution has begun, centered on the United States and Japan, focusing on the industrialization of farming in many developing countries, especially in Iraq. Agricultural machinery, chemicals, fertilizers, etc., have increased world food production at an unprecedented speed, and the surplus has had a significant impact on food supply and food prices. As low-cost and high-quality food products circulate, the dietary habits of people in each region have become increasingly diverse and have expanded throughout the world.

Agricultural production, as well as agro-industrial activities, are regions influenced by a series of parameters linked to their economic role within a given area, such as the nature and function of agricultural rotation, technological progress in the industrial area and in agricultural practices, and the personal capacity to motivate and lead the population’s agricultural and vocational development, as well as involving them in various projects, programs, and activities. Agro-industrial activities are permanently influenced by the main natural harvesting in agricultural zones, mainly from growing livestock. Through various industrial objectives, we can also influence agricultural practices. Mind the industrial activities directly correlated to obtaining raw material directly from agriculture, while many crops currently existing in these plantations result from harvesting influenced by various industrial practices directed at agricultural activities. The severe food shortage and high food prices, as a result of the political, administrative and regulatory conditions in Iraq in recent years, lead to serious consideration of how to maintain food supplies. It opens the door to future scientific research for food and animal industries directly related to agriculture. This represents the vital point in future because of its direct importance in the agricultural sector and people's lives.

Additionally, the research may not incorporate complex climate change modeling or projections, focusing instead on current challenges. Which, issues of

food sourcing and international food systems are becoming apparent. The occurrence of food shortages is an economic problem, with many causes including climate change, auxiliary activities, and the expansion of bio-energy plants. Environmental degradation, such as water shortages, soil depletion, biodiversity loss, pollution, and resource depletion, including oil and gas reserves, are also contributing factors. Thus, we see that the issue of food has a broad societal and economic impact. At this point in time, it seems that, from the perspective of the agricultural industry, it is difficult to understand the changing conditions in agriculture, even without research and understanding of the dynamics of agriculture and the socio-economic climate in which farmers are involved in these dynamic processes.

Sustainable agricultural production is increasingly under threat from climate change. Setting aside ongoing and controversial debates about the precise effects of climate change, neither its general trends nor its symptoms are new. These changes are exacerbating the unmitigated agro-environmental conditions currently faced by a majority of farmers. In other words, smallholder farmers, especially those located in remote regions, are drastically experiencing such changes because of their limited options for responding to crop-threatening pests and diseases and the demographic explosion. These climate change-induced challenges are, for the time being, preventing agricultural production from meeting growing demand and further jeopardizing the livelihood of smallholder farmers. One compelling example is the case of climate change biotic risk, which is regarded as a major threat to the sustainability of agriculture, where a majority of the population depends directly on agriculture for their subsistence. As each damaging source of climate impact raises costs for farmers in terms of yield loss and control measures as well as for the environment, the contribution of plant pathology is of great importance to farmers who need strategies to limit these increasingly costly impacts, even if these remain difficult to anticipate in practice. The main causes should be studied extensively. One of the biggest causes of these problems is the change in temperature, scarcity of water in rivers, lack of rain, etc. Thus, addressing current and future climatic challenges directly affecting farm productivity of food crops and their financial importance remains key to the implementation of sustainable development globally.

Moreover, changes and transformations are important for socio-economic research to reveal the current climate change pressures, not only from the perspective of farmers living near farmland, but also to understand the mechanism that links different socio-economic activities to the production activities of individual farmers. As a result, in this study, socio-economic activities such as production, management, legislation, environment, transportation and sales are considered simultaneously. In particular, there is a lack of review of the impact of climate change on agricultural production. In the future, if climate change occurs with drought and temperature stresses, it will cause serious environmental degradation. It will be necessary in the future to investigate what kind of strategy is required in the agricultural industry as a comprehensive research case covering environmental change studies and its impact on food security.

Data limitations are more explicitly explained and addressed as follows: Identifying data limitations: The research faces challenges related to data collection in Iraq, such as the lack of comprehensive coverage, the unavailability of up-to-date official statistics, and the variability in the accuracy of agricultural data due to political and economic instability. Poor documentation of records in rural and conflict-affected areas also leads to a lack of comprehensiveness of the data.

Biases may arise from relying on official sources that may reflect government orientations or be influenced by certain policies. Furthermore, the difficulty of accessing some areas, especially those affected by conflict, may lead to data gaps or misrepresentation. Furthermore, the use of secondary data may contain biases inherited from previous studies or errors in reporting. To address these limitations, these issues were mitigated by using multiple data sources, including reports from international organizations, academic research, and internet-based data analysis to verify agricultural production statistics. Sensitivity analysis was also conducted to assess the stability of the results, and statistical methods were used to address data gaps and inconsistencies. For future improvements and data reliability, collaboration with research institutions can be strengthened, field surveys can be conducted to collect more accurate primary data, and artificial intelligence techniques can be leveraged to analyze agricultural patterns. Enhancing

government transparency and making more detailed economic and agricultural data available will also contribute to raising the quality of future research. By clearly addressing these limitations, the research ensures a higher level of transparency and credibility in its methodology.

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Appendix 1: Waqf: An advanced approach to combating agricultural land fragmentation in Islamic countries

The *Waqf*: An Advanced Approach to Combating Agricultural Land Fragmentation in Islamic Countries

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Abstract: This paper addresses the issue of agricultural land fragmentation in Islamic countries. In those countries, agricultural land is fragmented into tiny and unproductive holdings. Fragmentation of agricultural holdings reduces production due to difficulties in applying modern technology, lack of access to loans, and the challenges of marketing small quantities. The inheritance system, based on Islamic law, is one of the biggest reasons that causes land fragmentation. Previous complex laws to address land fragmentation often conflict with national constitutions or Islamic law, making implementation difficult. A mixed-methods approach was employed, combining qualitative analysis with a one-way analysis of variance (ANOVA) to examine differences in productivity and operational costs per hectare under various land management systems. The findings demonstrate that implementing waqf (endowment) as a land management strategy can significantly mitigate land fragmentation. Waqf preserves agricultural land as a single, indivisible entity, allowing for long-term planning, farm expansion, and sustainable investment. This approach enhances productivity and supports sustainable agricultural development. The study concludes that waqf aligns with Islamic principles and offers a practical, culturally appropriate solution to land fragmentation. By mitigating fragmentation and promoting sustainable development, waqf ensures continuity, supports agricultural growth and contributes to broader development goals.

Keywords: Agriculture Economics, Agriculture Land Fragmentation, Islamic Inheritance law, Endowment, *Waqf.*

1. Introduction

Land plays a crucial role in providing people with livelihoods. In all societies, land serves as a primary means of work and food security *[1,2]*. Achieving economic sustainability and boosting agricultural output in Islamic countries requires legislation embracing waqf principles.

However, the most binding constraint of growth and investment in agriculture is the farm size *[3]*. Small farm size results in limited access to physical assets, credit, and modern technology and increased costs of opening new irrigation canals *[4]*.

Land is the main source of food and financial security, it is a limited and non-exhaustive resource and its value is unlimited *[5]*. As the general population of the world continues to grow, demand for land increases, leading to high competition for its use in various sectors such as urban growth and agronomy *[6,7]*. The impact of farm size on output is very large. The smaller the land area, the lower the efficiency, in terms of lower yields, increased costs and reduced competitiveness *[8]*. Understanding this impact can assist in developing policies aimed at reducing fragmentation and enhancing productivity efficiency, thereby improving food security and increasing farmers' incomes *[9]*. This study intends to investigate how agricultural land fragmentation affects sustainability and productivity *[10]*. The study's second objective is to find out the proposed

solutions are consistent with Islamic economic principles. On top of that, it hopes to offer lawmakers actionable advice.

The positive side effect of *waqf* is that it is a very effective tool to address the fragmentation of agricultural lands. This research has dealt with the concept of Islamic *waqf* (*in plural, awqaf*), as a centuries-old practice system that ensures the survival of the property.
The research also seeks to improve the administrative system of the land and provide scientific advice to decision-makers and legislators *[11]*. Unifying the land and reducing its fragmentation are measures and policies that must be initiated, and cooperation between farmers must be enhanced by strengthening the role of agricultural associations and agricultural cooperatives, and also perhaps using *waqf* funding to support these projects *[12]*.
The major obstacle to increasing agricultural production is land fragmentation and the research objectives are of utmost importance because there is an urgent need to address this problem *[13]*. Successful policies are those that are feasible, implementable, and have a short distance between theory and practice, which enhances development *[14]*. Since the research takes Islamic economics as a path, the general objectives help to achieve international Islamic cooperation in the field of land management.
The main research question of this study is: "How can *waqf* principles be used to address agricultural land fragmentation and improve productivity and food security in Islamic countries?"

One-way analysis of variance (ANOVA) was used in this research to investigate the statistical differences between different types of agricultural land in terms of wheat productivity per hectare and operating costs per hectare. The aim of applying ANOVA is to find out if there are statistically significant differences between fragmented lands owned by individuals and *waqf* lands owned by Al Rajhi *waqf* in terms of productivity and costs. This analysis helps to determine the effect of land size and type on productivity and economic efficiency and allows us to make accurate conclusions about the best practices for achieving higher productivity returns in agriculture.

This study explores *waqf*'s role in addressing the problem of land fragmentation in Islamic nations. The research starts with First an introduction to the issue. A literature review on land fragmentation, Islamic inheritance laws, and *waqf* principles. Historical and modern applications of *waqf* are examined to highlight its effectiveness. The study details the causes and legislative challenges of land fragmentation, arguing that Islamic principles, especially *waqf*, offer practical solutions. The concept and importance of *waqf* governance across cultures, geographies, and economies are discussed. Then, the statistical analysis of the waqf data. The discussion synthesizes findings, highlighting the study's unique contributions and practical recommendations.

2. Literature Review

The land fragmentation case in most parts of the world is a serious problem *[15]*. This results from several historical, institutional, political, and social factors, including inheritance laws, collectivization, high land transaction costs in markets, expansion plans emphasizing urban areas, and individual valuation of land tenure *[16]*. Consequently, the effects of fragmentation on farm output have been the subject of several empirical studies. An analysis examined “the impact of land fragmentation as measured by average field size on the average cost of producing wheat in the rain-fed region of Northern Jordan.” The research found that the average variable cost of producing wheat decreases as field size rises. Land fragmentation increases output costs, and continued land fragmentation will decrease efficiency, particularly when it results in smaller fields” *[17]*.
The relationship between technical efficiency and land fragmentation in rice production was specifically studied, and it was discovered that increased fragmentation led to lower efficiency. The study thoroughly examined the negative impacts of dispersed landholdings on agricultural production *[18]*. A wider range of crops was examined in 2001, focusing on the significant impact

of land fragmentation on several agricultural sectors. It explored the need to develop solutions and remedies to address this problem and improve production *[19]*.

The technical efficiency of various crops is negatively impacted by land fragmentation, which highlights the necessity for policy interventions to address fragmented landholdings *[19]*. This was supported by a comprehensive experimental study to evaluate the impact of fragmentation on agricultural production efficiency. This study used econometric methods. This study highlighted the need for land consolidation and reconsideration of reform policies to increase crop yields in China.

A study conducted in Bangladesh on the effect of land fragmentation on production efficiency found that the more fragmented the land was, the higher the indicator of technical inefficiency and greater yield loss *[20]*. Numerous studies have analyzed the negative influence of land fragmentation on farm efficiency in empirical case studies *[21,22]*.
Economically, applying new technology in small agriculture holdings, whether a plant or animal project is difficult [23]. Productivity will only improve with modern technologies, including modern irrigation machinery, improved plants and animal species, and better care for crops before and after the harvest *[24]*. Smallholders often have difficulty accessing the loan because they do not have enough land size to guarantee (an acceptable land size for the bank, real estate for the bank instance), that the price of a small piece of land is not worth a sizeable amount. The high cost and the difficulty of obtaining loans thus cause impediments to production. The banks require for credits the minimum land size of one hectare, farmers with smaller lands cannot have loans. Recently, the land has been allocated as small pieces for housing. This incentivizes poor farmers to sell their land *[25]*. The fragmentation of agricultural lands is a major constraint for investment and production, thus preventing sustainable agricultural development. It reduces the efficiency and profit *[15]*. It is also a major factor causing food insecurity, poverty, social instability, and migration from rural to urban areas *[23]*. Hundreds of years ago, Islamic *fiqh* proposed the principle not to divide and confine wealth."*Waqf* is a financial, charitable institution established by withholding immovable and movable properties to perpetually spend its revenue on fulfilling public or family needs, depending on the preferences and conditions set by the founder. Once the property is created as *waqf*, it can never be given as a gift, inherited or sold".
The *waqf* seeks sustainable development by providing a public service or service to the family free of charge and permanently. The Islamic *waqf* system plays a significant role in preserving agricultural lands as an indivisible charity *[26]*. During the mid-19th century Ottoman occupation, a substantial portion of the lands was established as *waqf* lands. In the past, the authorities in Islamic countries sought to allocate a lot of land as *waqf*, and this helped to preserve large areas of agricultural land that continue to produce and achieve great prosperity to this day. For example, a third of Tunisia's land was *waqf*, half of Algeria's land, and nearly an eighth of Egypt's land. Hence, the *waqf* system preserves agricultural production and supports the welfare of society by preserving land with larger holdings *[26]*.

The study examines challenges hindering the optimal use of waqf properties in Malaysia. Comprehensive analysis based on empirical research, including library searches and interviews with State Islamic Religious Council representatives *[27]*.

This study examines the importance and effectiveness of the *waqf* institution in Islamic countries throughout history and how it has effectively contributed to development. It sheds light on the charitable idea and other advantages of *waqf*, such as encouraging growth, reducing government spending, and alleviating poverty. *Waqf* differs from other charitable works in that it is permanent and uninterrupted, and the study recommends the need to update the administrative systems of the *waqf* institution *[28]*.

To combat food insecurity, policymakers should encourage and activate the use of *waqf* lands *[29]*. *Waqf* still operates under the old administrative system run by volunteers, it has become

necessary to pay attention to the quality of management of these institutions. The establishment of a unified administrative system and legal framework for *waqf* institutions is a must, as these communities need a charitable institution such as *waqf*. As part of this reform process, departments and administrations should cooperate with each other to coordinate the collection and modification of *waqf* lands, and also arrange *waqf* financing more effectively. Government programs can focus on sustainable agriculture by utilizing *waqf* lands *[29]*.

The literature indicates that there is a significant gap in addressing the problem of agricultural land fragmentation. The solution here revolves around how Islamic thought can contribute to addressing this problem. By formulating the research question, this study seeks to address the issue of land fragmentation and provide practical solutions from Islamic principles, thus improving production and, subsequently, food security in Islamic countries.

2.1. Islamic Inheritance Law and Wealth Fragmentation

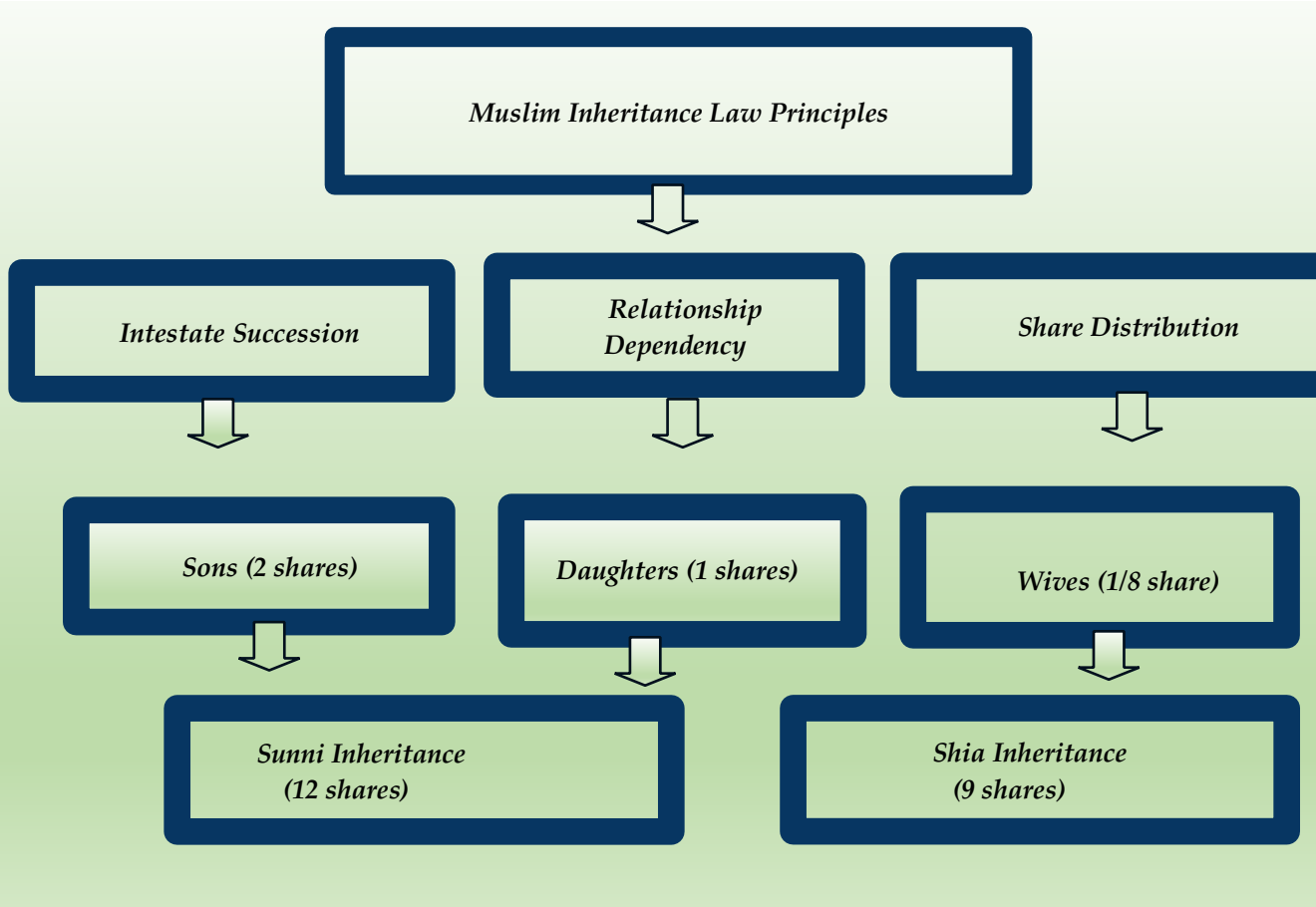
The inheritance system was one of the significant reasons for the economic underdevelopment of Middle Eastern Muslim countries compared to Christian European countries. The system dictates that agricultural land or any property must be divided after the owner's death. Recently, traditional partnerships have been commonly used for business in Middle Eastern Muslim countries *[30]*. The question is why those partnerships have yet to give rise to more sophisticated organizational forms *[31]*. This happened in Europe approximately ten centuries ago when resources were pooled with simple partnerships *[32]*.

A few centuries ago, they were pooling resources in public trade corporations. Large businesses in Middle Eastern Muslim countries always face a problem of fragmentation. By the 17th century, thousands of Muslim Middle Eastern people were investing in organizations that were not long-lived and could not live without their founders *[31]*. So, what happened to those countries was preventing the emergence of modern organization reforms. The main reason for business fragmentation was the Islamic inheritance system. Although it was a very egalitarian system, and the Muslim people have praised the inheritance law (at least, compared with some Christian schools), inheritance always had the disadvantage of fragmenting successful businesses. Successful businesses could not be passed from one generation to the other, or only with difficulties, and for a very short time, that meant the wealth went fragmented *[30,31]*.

The Islamic inheritance system is highly egalitarian; it is not possible to disinherit a son or a daughter. However, a daughter gets only half of the son's share, but she stays entitled to this share. Any surviving spouse (s) (under Islamic law, people could have multiple wives) were entitled to shares *[30]*. According to the Islamic inheritance law, Muslims will have a share in what their parents or close relatives leave behind, whether land or property *[33]*. This is spelled out in the holy Quran: “There is a share for men and a share for women from what is left by parents and those nearest related, whether the property be small or large – a legal share” *[34]*.

The Muslim Inheritance Law is based on six principles: First, all the shares are spread to legal heirs by intestate succession”. “Second, the inheritance shares rely on the relationship of the legal heirs to the deceased. The blood relation has the closest ties, the inheritance shares are distributed depending on how many brothers, sisters, and children are in the family. Third, sons have two shares; daughters have one share, and wives inherit one-eighth of their husband's property. Fourth, heirs get an absolute advantage in this specific share of the estate of their ancestor; that right even exists before distribution, for example, when the heir dies, assuming before distribution, they were alive at the ancestor's death. The share of their vested inheritance passes on to their heirs. Fifth, under the Sunni inheritance law, there are twelve shares in a deceased property of the person, four shares for the males and eight for females. The Shia sect inheritance law has nine shares that do not include granddads or grandmothers” *[33]*. Sixth, all the deceased's assets, including houses, money, and agricultural land, are distributed based on Islamic inheritance laws. As depicted in Figure 1, the division follows widely practiced principles, allocating shares according to gender, kinship, and sect-specific guidelines.

Figure 1: The Islamic Inheritance Principles



Source: Authors' own elaboration based on [35,34].

Due to the large number of children and polygamy in Middle Eastern Muslim countries, especially in rural communities, the land of a few hectares will perhaps be divided into small holdings per individual in a few decades. Inheritance is a religious right and cannot be reduced by policies, which increases the problem *[36]*. It isn't easy to preserve inherited property intact across generations. For instance, land ownership patterns in certain Muslim countries at the beginning of the 20th century display the division of cultivable land into uneconomically small plots due to population growth and the Islamic inheritance system *[36]*. In theory, shares could be put together even after the assets had been distributed. However, some people inevitably do not want to continue, or because they are not into the business, they may prefer to have their share as cash. That is why, in the Middle East, no commercial families' dynasties were founded. This is the first reason why large businesses have not emerged *[30]*. On the other hand, which is more critical, because the inheritance system fragmented wealth, people had a disincentive to form large companies and partnerships. If someone has a business partnership with 30 people, the chances of a member passing away are high. However, keeping the partnership after the death of one member is very difficult. Then, there is the risk of dealing with that member's heirs *[30]*. This fragmentation can be very costly. So, the punchline here is that people keep these partnerships very small. Small partnerships did, however, not generate the coordination and communication to develop more sophisticated organizations. Moreover, "The ban on usury (*Riba*) made it very difficult for businessmen to obtain credit and suppliers to lend. Likewise, the ban on interest meant that banks could not emerge. The usury ban penalty leads to the fact that non-Muslims can't do business with Muslims" *[37]*. "O believers! Fear Allah, and give up outstanding interest if you are ˹true˺ believers.278, If you do not, then beware of a war with Allah and his Messenger! But if you repent, you may retain your principal neither inflicting nor suffering harm" *[34]*.

The European countries had different inheritance systems in the Middle Ages. In Europe, the inheritance system was not tied to the Bible, which does not specify an inheritance law *[30]*. There was a bewildering variety of inheritance systems, and one of these systems proscribed that the estate goes entirely to the oldest son. This is not egalitarian at all but rather very unfair to the second son or the third and the daughters, who do not get any share of the business. However, the advantage is that the successful business can be passed on to the oldest son *[37]*. When passed on to the son, he usually develops it, and the business grows much more through communication and coordination *[37]*.

Focusing here on agricultural land and the causes of its fragmentation, and the legislation that attempts to address this fragmentation, it can be said that these laws failed to promote the optimal use of land. the deficiency in the legislative organization, or what is called "legislative omission," is achieved by the fact that the legislator dealt with one of the topics that it specializes in regulating, but this regulation - whether intentionally or negligently - is incomplete or fails to encompass in all its aspects, which leads to disruption or negative impact on any aspect of economic, social, etc. life *[38]*.

Several Middle Eastern Muslim countries, such as Iraq, Egypt, Saudi Arabia, and Syria, have tried to solve this problem, but to no avail, and the fragmentation problem still exists. For example, Iraqi Law No. 286 of 1987 and Egyptian Law *[23,39]*. contrary to Islamic law and contradicting the constitutions of these countries, forcing people to sell their shares and registering the inherited, sold, or gifted pieces of land (no less than 5 Hectare size) in the name of only one person determined by law, or selling the land at auction to a farmer. The constitution and Islamic law guarantee ownership rights. Restricting ownership and impeding the owner's freedom is considered a violation. Despite successful land laws, the issue of land fragmentation persists due to the retention of traditional Islamic inheritance laws *[40]*.

The Middle Eastern Muslim countries use *Sharia* (Islamic law) as the sole. Some of them use Islamic *Sharia* as a main source of legislation, or the formulation of legislation in these countries does not conflict with the Islamic religion *[41]*. Laws and legislation must stem from the culture and values of society, as they may be more transparent and have broader support and societal acceptance. Therefore, including religious, cultural, and customary concepts in-laws can enhance social commitment *[42]*. The issue of inheritance legislation in courts in Middle Eastern Muslim countries is a religious issue inspired by Islamic law *[33]*. Therefore, to treat these problems, the legislator must refer to religious legislation and consider it instead of treating religious law with customary law, statutory law, or a law that applies to another society. One of the biggest reasons for the fragmentation of agricultural holdings is inheritance, but Islamic *fiqh* and law have found solutions to the emerging issues *[43]*. This means that if aftermath or damage occurs and the current legislation does not work, the amendment is possible in Islamic law. At the time of the previous legislation, there was no harm, but harm arose and developed with the development and complexity of life.

From a pragmatic view, legislating a religious law is very good because society considers that adherence to the law is derived from divine command and heavenly legislation. Religious law provides a great benefit because people may respect it more than positive law, especially in this type of society *[44]*. Land fragmentation harms and threatens the economy, food security, and people's lives. According to Islamic law, prohibition and forbidding are established where harm is found, and they do not continue with the action that causes harm. "And spend in the way of Allah and do not throw [yourselves] with your [own] hands into destruction [by refraining]. And do good; indeed, Allah loves the doers of good" *[34]*.

Neither Harm nor Damage: Removing the harm from whoever inflicted it is necessary. The basis for this rule is what *Malik* narrated in *Al-Muwatta*, *[45]*, that the Prophet Muhammad (Peace be upon him) said: "Neither Harm nor Damage" because Sharia law is based on bringing benefits and repelling harms, and it falls under this rule *[45]*. The hadith clearly indicates that a person is not required to harm himself and others *[46]*.

The benefits of hadith it is considered a general principle in Islamic law, stating that any action causing harm is prohibited. It prohibits harming oneself or others by putting them in danger or committing forbidden things. It also avoids all harm to oneself and others, money, one's family, and one's honor. One of the fundamental goals of Islam is to prevent harm before it occurs and to remove it after it occurs *[46]*.

Providing a quick solution based on the principles of Islamic jurisprudence could be a crucial step in saving agricultural lands from fragmentation. This solution is based on converting the ownership of agricultural lands into *waqf* so that the land is preserved permanently and not divided across generations.

2.2. Sustainable Development through the *Waqf* System: Lessons from History

The *waqf* system is a historically proven institution that has effectively prevented land fragmentation while ensuring its benefits for families and the public. By safeguarding land from division through inheritance, sale, or gifting, waqf maintained the integrity of landholdings. Beyond preservation, it supported social welfare, including education and infrastructure. This legacy highlights *waqf*'s enduring relevance as a model for addressing modern challenges of land fragmentation and promoting sustainable development. This constituted a significant contribution to ensuring the sustainable development of agricultural land in the Islamic era *[26]*. A good landmass had been set aside as *waqf* in the Islamic countries, which curbed the line of land division. The significance of *waqf* represents not only the mere safeguarding of land but also an economic framework that has helped in wealth distribution and delivery of social welfare. Today, it has been able to sustain the unity of agricultural lands and their fertility with the permanent feature of *waqf* property, consequently contributing toward lasting food security and economic stability. Otherwise, it was the *waqf* system that provided a platform for establishing essential public infrastructure, like institutions of education, centers of health, and networks of irrigation, that were crucial for the comprehensive development of the respective societies *[20]*. As shown in Table 1, several studies at different times have presented the benefit of the *waqf* as a permanent benefit, by preserving the principal from fragmentation.

Table 1: Historical Effectiveness of *Waqf*

Year/Period	Event/Impact
8th Century	**Introduction of *Waqf*:** Early Islamic caliphates formalize the *waqf* system as a means to manage charitable *waqf*.
Ottoman Era	**Land Preservation:** Large tracts of agricultural land in regions like Tunisia, Algeria, and Egypt are set aside as *waqf*, preventing land fragmentation.
2006	Observations on the effectiveness of *waqf* in sustainable development of agricultural land during the Ottoman era.
2008	Analysis of *waqf*'s role in establishing public infrastructure and its contribution to societal development.
2016 until today	**Evolving Role of *Waqf*:** Continuation of *waqf*'s impact on land unity and fertility, contributing to food security and economic stability.

Source: Authors' own elaboration based on [20,26].

2.3. The Concept of Islamic *Waqf*

The term *waqf* in the Islamic context linguistically means to stop, contain, or preserve. It refers to a religious *waqf* where an asset, such as land or property, is donated for charitable or religious purposes, ensuring its use is preserved for the benefit of the society perpetually. *Waqf* is an institution for doing permanent good, and Muslims invented the historical formula to draw closer

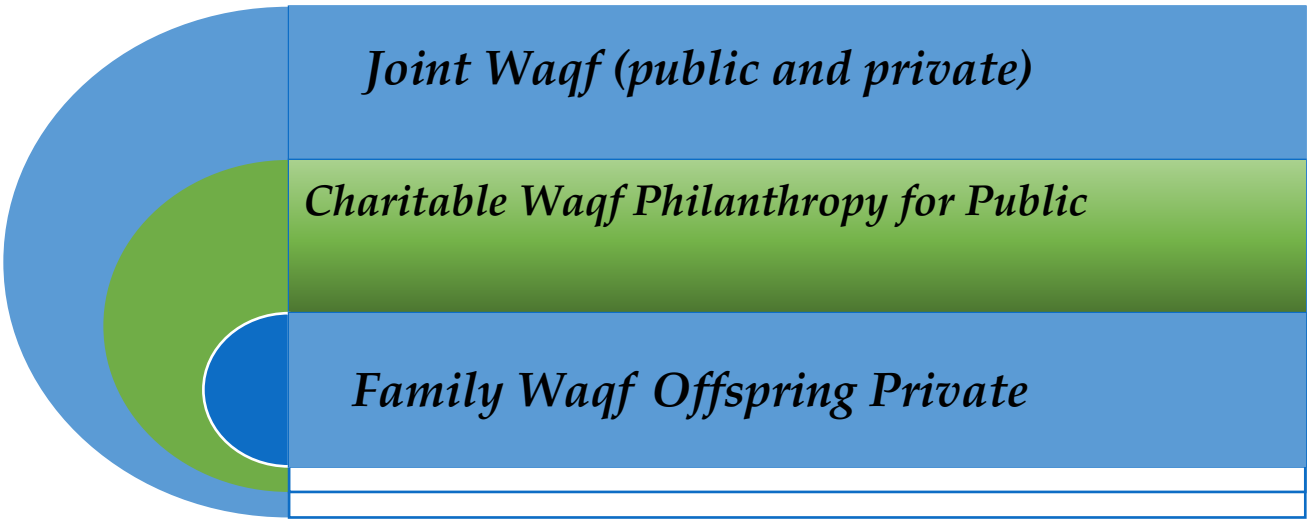
to God through participation in building their societies and repopulating the land. The *waqf* is permanent because it is an asset such as a school, factories, agricultural land, or any charitable institution, and in most cases, it is productive, generates money, and employs employees *[47]*. Any private property can be a *waqf*, provided that ownership is relinquished for the Private Family *Waqf*, Public Charitable *Waqf*, or Joint *Waqf*, and it must be for charitable purposes [48,49]. Those that go into use are considered charity, such as food, money, and others [50]. *Waqf* differs from charity in that giving ends with its spending, whereas *waqf* means the asset locked up in constant spending continues at the peak of goodness even after death. As evidenced in Table 2, shows the similarities and differences between charity and *waqf*.

Table 2: The similarities and differences between charity and *waqf*

Comparison	**Charity**	***Waqf***
Differences	It is given to the poor and needy	Given to society as a whole
	It is possible to own, sell, and give it away; it can also be returned.	It cannot be sold, inherited, given away, or returned.
	Charity is temporary, such as providing food or immediate assistance to someone in need, perhaps once, [29].	The nature of the *waqf* is permanent and relates to buildings such as schools, mosques, farms, and others.
Similarities	Both are close to God Both have a great role in social solidarity Both have a great role in community development	

Source: Authors' own elaboration based on [48,50,51].

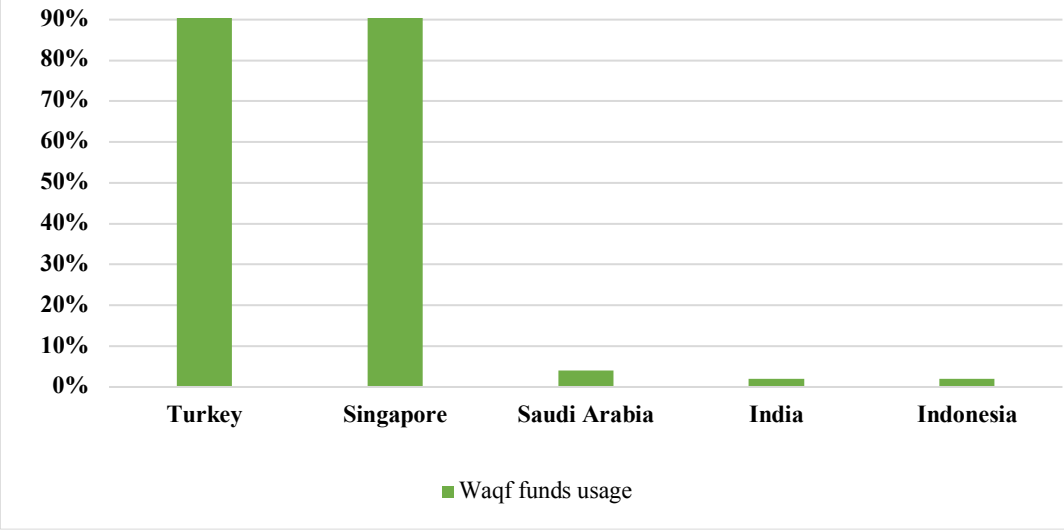
Family Waqf (offspring): This type aims to benefit specific individuals or their descendants, whether relatives or offspring.
Charitable Waqf: Dedicated to one or more charitable purposes, intending to bring the donor closer to God Almighty.
Joint Waqf: A combination of Family Waqf (offspring) and Charitable Waqf, serving both personal and charitable goals. Figure 2 below illustrates the classifications of waqf and demonstrates how these types can be combined.
Figure 2: The Types of *Waqf*



Source: Authors' own elaboration based on [52,50].

The concept of *waqf* represents a shared principle across cultures and geographical regions, while its implementation is influenced by cultural, geographical, religious, and economic variables. Nevertheless, the judgments can differ depending on how the Muslim communities perceive the *waqf* and how they practice it in relation to their local customs and traditions. *Waqf* is geographically diverse depending on the reasons and nature [53]. The utilization of *waqf* funds for development varies across different geographical areas. Figure 3, explains the funds used in development for example, Turkey uses 96% of its *waqf* funds, and Singapore utilizes almost 92% of them for development purposes. In comparison, other countries such as India and Indonesia only allocate 2 percent of their *waqf* funds for development, while Saudi Arabia uses up to 4 percent [54].

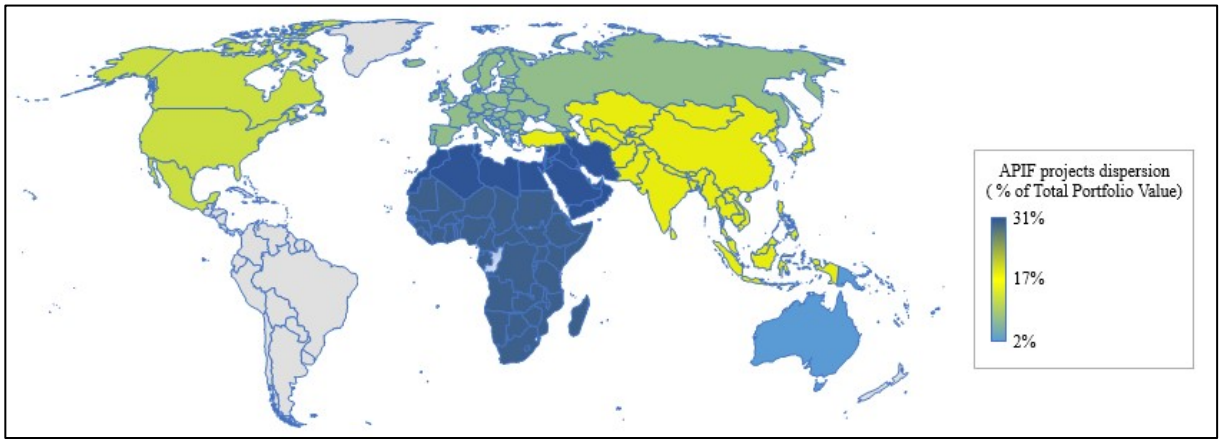
Figure 3: Difference in *waqf* funds used in development in various countries 2000-2010



Source: Authors' own elaboration based on [54].

As a sign of the importance of the *awqaf* in Islamic society and culture, the Islamic Development Bank *[55]*. has created a bold initiative to autonomously channel and catalyze multiple activities linked with the spirit of this kind of institution: The *awqaf* Properties Investment Fund (APIF) program. This venture is responsible for managing a huge portfolio of activities that are carried out worldwide. As evidenced in Figure 4, the largest amount of funds is applied in the MENA region (31%), followed by the African continent (30%) and Asia (18%). Although to a much lesser extent, the program is also present in North America (12%), Europe (7%), and Oceania (2%).

Figure 4: Global expansion of the Awqaf Properties Investment Fund



Source**:** Authors' own elaboration based on [55].

Moreover, the types of *waqf*, the charitable causes they support, and the governance structures can vary significantly due to regional and historical practices [56]. *Waqf*'s identity is deeply intertwined with cultural and societal dynamics, reflecting the unique priorities and values of each community. Local traditions and cultural norms shape how *waqf* assets are allocated and managed, tailoring initiatives to meet specific needs. Economic disparities also influence *waqf* structures; affluent regions often establish larger endowments to fund long-term development, while less prosperous areas focus on urgent social challenges. Yet, the essence of *waqf* remains unchanged—a dedication to leveraging assets for the collective welfare of society. *Waqf*'s adaptability across cultural, geographical, religious, and economic contexts without compromising its foundational principles is a testament to its resilience [57].

3. Statistical Analysis

Saudi Arabia has achieved a qualitative leap in agricultural production in the last 15 years, especially in grains, dates and field vegetables and wheat. This was a side effect of what the Saudi General *waqf* Authority has achieved in collecting and managing *waqf* lands *[58]*.
The Kingdom of Saudi Arabia was chosen in this research because it hasadvanced programs for *waqf* management for around 22613 plots of land.
One of the largest agricultural *waqf* is Al Rajhi *waqf* for wheat cultivation, was chosen as a model. Ten fragmented plots of land (84.6 hectare) were taken as another example for comparison in production, costs and management [59]

The average production and costs were calculated for two types of lands:
First, the type owned by small farmers is fragmented land, 52 pieces of land,
the total area is 84.6 hectares, which is always suffering from small size, low investment in inputs, and low use of mechanization. All these 52 pieces of land in our study, small, fragmented farms, were in the year 2017 annexed to Al Rajhi *waqf* and became part of it *[60]*, as in Table 3.

Table 3: Table Showing the Size and Area of Some Fragmented Plots of Land in Asir and Hail Cities

Plot Size (hectares)	Number of Plots	Total Area (hectares)
Less than 0.25	12	2.4
Less than 0.5	10	5

Less than 1	8	8
1	4	4
2	6	12
3	5	15
4	3	12
6	2	12
10	1	10
4.6	1	4.6
Total	52 plots	84.6 hectares

Source**:** Authors' own elaboration based on [60].

Second: The other type is agricultural *waqf* lands, and the example here is Al Rajhi *waqf* in the cities of Asir and Hail *[61]*.

The example in this research is about Al Rajhi Farms for wheat cultivation, which started with very small areas in 1982 and then expanded until it entered mass production in 2011. The *waqf* began to expand and collect neighboring lands and add them to the *waqf* (some of the neighboring lands come as a gift to this *waqf* and some are sold at symbolic prices and some of the unused lands are purchased with the right of pre-emption) until it reached 900 hectares in 2011 and in 2015 1100 hectares, and in 2018 1600 hectares and in 2023 it became 2000 hectares of lands used for wheat cultivation as shown in Table 4, *[61,62]*.

Table 4: Wheat Production *Waqf* Lands vs. Fragmented Lands in Asir and Hail Cities

Type of Agriculture land	**Year**	**Yield[a]**	**Average operating costs per hectare[b]**
Average of 10 plots (50 hectares) owned by farmers and small businesses, ranging in size from a quarter hectare to four hectares, fragmented and dispersed	2000	4.4	480
	2003	4.4	480
	2006	4.4	480
	2009	4.4	480
	2012	4.4	480

	2015	4.4	480
	2018	4.4	480
Waqf land of 900 hectares. Al Rajhi *Waqf*. Asir city	2011	5.5	610
	2012	5.5	630
	2013	5.7	630
	2014	5.7	690
Waqf land of 1,100 hectares. Al Rajhi *Waqf*. Hail city	2015	5.9	950
	2016	5.9	950
	2017	6.1	950
Waqf land of 1,600 hectares. Al Rajhi *Waqf*. Hail city	2018	6.5	1,150
	2019	6.5	1,150
Waqf land of 2,000 hectares. Al Rajhi *Waqf*. Hail city	2020	7.5	1,050
	2021	7.5	1,050
	2022	7.5	1,050
	2023	6.5	1,050

[a]Average Production, per hectare in tons

[b]Seeds, fertilizers, pesticides, irrigation, service, harvesting, transportation in U$

Source**:** Authors' own elaboration based on [62, 60, 61].

Table 5: Table Illustrating the Variation in Yield Quantities, Tons per Hectare for *Waqf* Lands vs. Frag mented Lands in Asir and Hail Cities

ANOVA table						
	Type of Agriculture land	**Mean**	**Std. Deviation**	**F**	**Sig.**	**Sig. level**
Yield [a]	Average of Fragmented Land	4.4	0	105.3	0	Very high sig
	Waqf land of 900 hectares	5.6	0.11547			
	Waqf land of 1,100 hectares	5.967	0.11547			
	Waqf land of 1,600 hectares	6.5	0			
	Waqf land of 2,000 hectares	7.25	0.5			
[a]Average Production, per hectare in tons						

Source**:** Authors' own elaboration based on [62,60,61].

In this ANOVA table, the agricultural productivity (average production per hectare in tons) is measured for different types of agricultural lands. Here's an interpretation of the data column by column:

1- In fragmented lands, the average yield from 2000 to 2018 was very low at 4.4 tons per hectare. While the average yield for *waqf* lands of 900 hectares was 5.6.
waqf lands of 1100 hectares had an average production increase of 0.3 tons per hectare, which is considered a good increase, as the average yield became approximately 5.96 tons per hectare. However, when the *waqf* area increased further to 1600 hectares, the average yield increased significantly, as it became 6.5 tons per hectare. When *waqf* lands became 2000 hectares for wheat cultivation in 2020 to 2023, the yield became much larger and achieved a qualitative leap with an average of 7.25 tons per hectare, as explained Table 5.

2- Std. Deviation: This represents the standard deviation, showing the dispersion of data around the mean.
waqf land of 1600 hectares and Fragmented land: Standard deviation is zero (0.000), indicating no dispersion; all values are identical.
Waqf land of 900 and 1100 hectares: Standard deviation is low (0.11547), indicating slight variation.
Waqf land of 2000 hectares: Standard deviation is 0.500, indicating some degree of variation.
F (F-value): This value measures the variance between the group means.

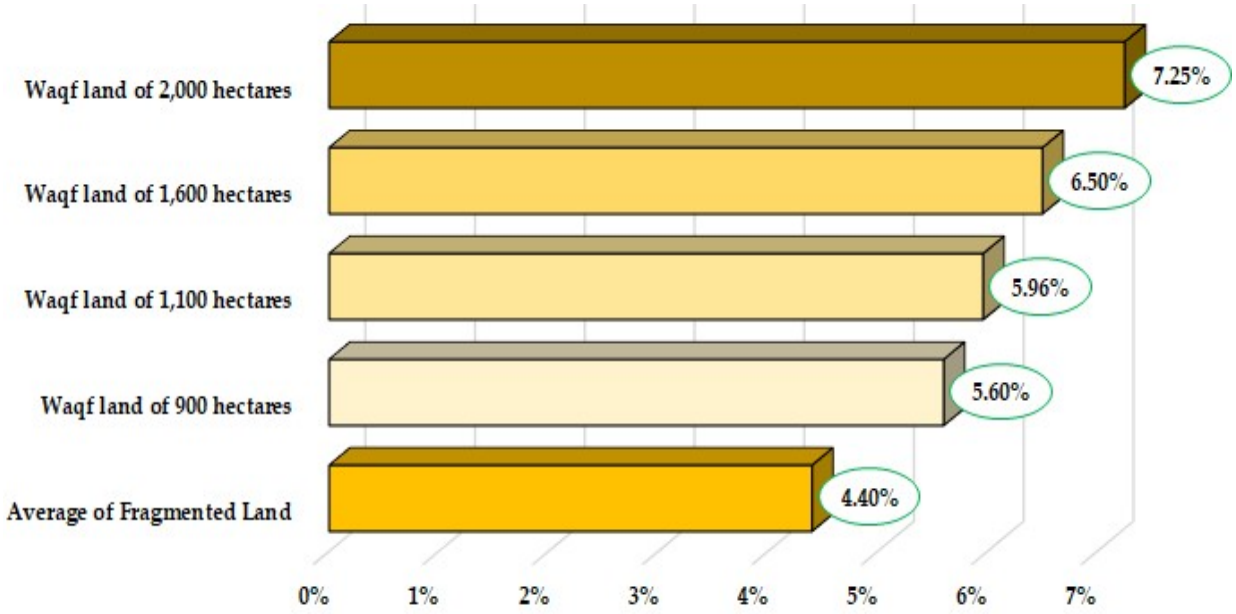
3- F = 105.304: This high F-value suggests a substantial difference between groups, indicating that the differences in productivity are likely not due to random chance.
Sig. (p-value): Indicates the statistical significance of the test.

4- Sig. = 0.000: This shows very high statistical significance, meaning there's a significant difference in productivity between the types of lands. This difference is not random.

There is a significant difference in productivity across the different types of land; productivity increases with larger land sizes, with larger *waqf* lands showing higher production rates compared to smaller or fragmented lands.
Since the p-value (Sig.) is less than 0.05, the differences in productivity between the types of land are statistically significant, suggesting that land size and type may have an impact on agricultural productivity.

Figure 5, shows the average wheat yield per hectare in Asir and Hail cities: a comparison of fragmented land and Al Rajhi *waqf* farms in the different sizes of the *waqf* land. The fragmented land had an average wheat yield of 4.4 tons per hectare, with a significant difference in the average production of 5.6 per hectare for *waqf* land size 900 hectares. For the more extensive *waqf* land, 1100 hectares, the average yield curve went up to 5.96. When the *waqf* land size was 1600 hectares, the curve rose to 6.5 tons per hectare. With the *waqf* land of 2000 hectares, the curve of the average yields went to 7.25.

Figure 5: Average Yield per Hectare, *Waqf* Lands vs. Fragmented Lands in Wheat Farms in Asir and Hail Cities



Source**:** Authors' own elaboration based on [62, 60 ,61].

In this ANOVA table 6, the focus is on the average operating costs per hectare for different types of agricultural lands. Here's an interpretation of the table based on each column:

Columns and Explanation
1-Mean: This represents the average operating cost per hectare for each type of agricultural land, as shown in Table 6.

Fragmented Land: The average operating cost is $480.00 per hectare.
waqf land of 900 hectares: The average cost is $640.00 per hectare.
waqf land of 1100 hectares: The average cost is $950.00 per hectare.
waqf land of 1600 hectares: The average cost is $1150.00 per hectare.
waqf land of 2000 hectares: The average cost is $1050.00 per hectare.

2- Std. Deviation: This represents the standard deviation, showing the spread of data around the mean.
Waqf land of 900 hectares: Standard deviation is 34.641, indicating some variation in operating costs per hectare.

Other land types (Fragmented Land, *waqf* lands of 1100, 1600, and 2000 hectares) have a standard deviation of 0.000, meaning there is no variation in operating costs for these categories—all values are identical.
3- F (F-value): This is a measure of the variance between the groups.

F = 1411.516: This is a very high F-value, indicating a significant difference in the average operating costs per hectare among the different types of agricultural lands.
Sig. (p-value): Shows the statistical significance of the test.

4- Sig. = 0.000: This indicates very high statistical significance, meaning there is a significant difference in operating costs across the different types of land. The differences are unlikely to be due to random variation.

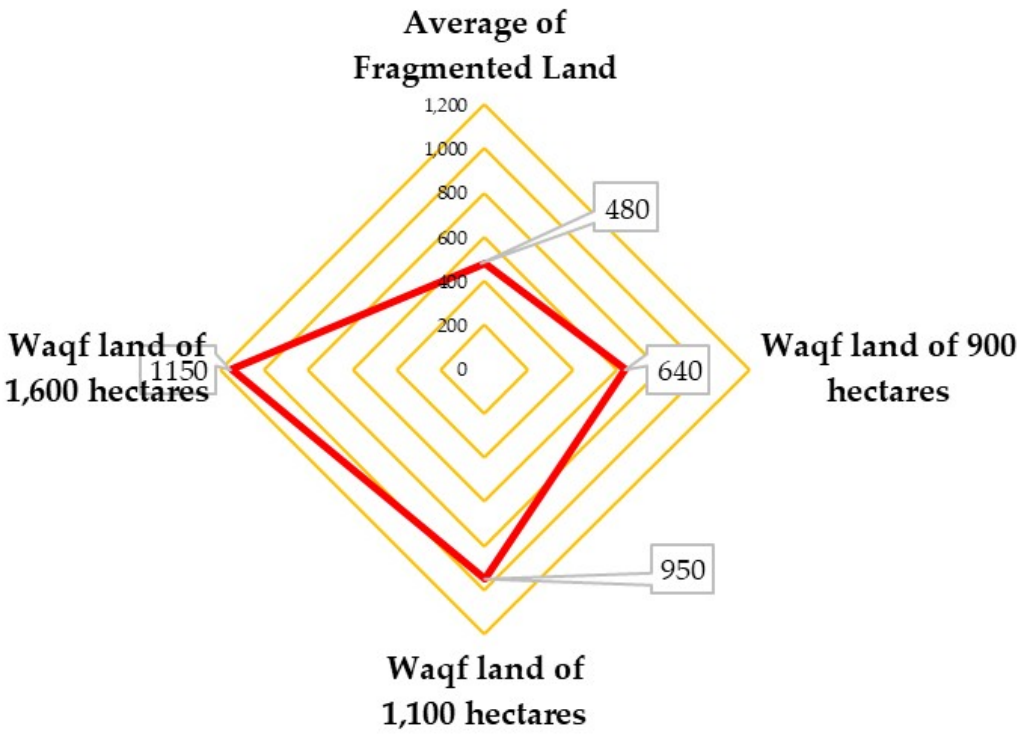
Table 6. Comparison of Costs Per Hectare: *Waqf* Lands vs. Fragmented Lands in Wheat Farms in Asir and Hail Cities

ANOVA table						
	Type of Agriculture land	**Mean $**	**Std. Deviation**	**F**	**Sig.**	**Sig. level**
Average operating costs per hectare	Average of Fragmented Land	480	0	1411.52	0	Very high sig
	waqf land of 900 hectares	640	34.641			
	waqf land of 1,100 hectares	950	0			
	waqf land of 1,600 hectares	1150	0			
	waqf land of 2,000 hectares	1050	0			

Source**:** Authors' own elaboration based on [62,60,61].

The average operating costs per hectare vary significantly across the different types of land. Larger *waqf* lands generally have higher operating costs, with the *waqf* land of 1600 hectares having the highest cost (1150.00 per hectare), followed by the *waqf* land of 2000 hectares ($1050.00 per hectare). Fragmented land has the lowest average operating cost ($480.00 per hectare). Since the p-value (Sig.) is less than 0.05, the differences in operating costs between the types of land are statistically significant, suggesting that land type and size might influence the costs associated with operating these lands. The figure 6 illustrates the relationship between average operating costs per hectare and different types of agricultural land. We can see from the graph that fragmented land has the lowest operating cost ($480), while operating costs gradually increase with the size of *waqf* lands, reaching the highest operating cost ($1150) for *waqf* land of 1600 hectares.
It's important to note that an increase in operating costs is not necessarily a negative factor, as it is often associated with increased productivity. Although larger lands incur higher operating costs, their productivity is generally higher, contributing to an overall improvement in returns.

Figure 6: Average Operating Costs per Hectare: Comparison between *Waqf* Lands vs. Fragmented Lands in Wheat Farms in Asir and Hail Cities



Source**:** Authors' own elaboration based on [62,60,61].

Finally, as shown in the figures in Table 5 and Table 6, ANOVA and also Figure 5 and Figure 5, show that the level of production per hectare of fragmented lands managed by farmers reached an average of 4.4 per hectare compared to *waqf* lands, which reached an average of 7.25. The average production increased gradually and clearly due to the increase in the size of the *waqf* from 900 hectares to 1100 to 1600 until it reached 200 hectares, and also the increase of inputs. Input value increased from $610 per hectare to $1050 per hectare with the land of 2000 hectare. There is no doubt that the increase in land areas through long-term management and plans, as well as the introduction of modern inputs for production, had a positive impact on increasing production and increasing yields, and all of these positives are available in *waqf*.

4. Discussion

Several economists argue that privately owned land can enhance farmers' productivity. Although this may be true in the short term, long-term experiences suggest otherwise. Over time, small privately-owned landholdings tend to fragment, posing a risk to production and food security. The division of smallholdings through inheritance can occur at any time, ultimately jeopardizing the economic viability and original purpose of the farms. These words do not necessarily advocate for feudalism or capitalism systems, which may result in a land monopoly. However, based on previous data, it is imperative to reach a reasonable solution. The solution lies in encouraging production while simultaneously halting the fragmentation of agricultural lands. Consequently, the Islamic economy was revived, which initially addressed this problem.

Finding an outlet that prevents landowners from acting unfavorably towards agriculture is crucial. *Waqf* can serve as an outlet that preserves the land for life. The Prophet Muhammad (Peace be upon him), said: "Whoever owns the land and then leaves it for three years and does not rehabilitate it, then people come and rehabilitate it, then it belongs to the one who rehabilitated it" [63]. This is related to the authority of the Prophet Muhammad: (Peace be upon him), "Whoever revives a dead land, it belongs to him". As the world's population continues to grow, demand for land increases, leading to competition for its use in various sectors such as agriculture and urban development.

Based on the previous idea implemented by the Islamic system, the mechanism worked to reduce the fragmentation of agricultural lands. The required approach can be developed to improve the agricultural reality and preserve agricultural lands using the best legislative methods. The new approach can combine property rights and freedom to dispose of them and create a modern idea that limits land fragmentation. This contemporary approach helps in collecting the largest amount of agricultural land and, at the same time, addresses the negative points that were in the previous laws. For example, the main negative of the inheritance system, as mentioned previously, was the fragmentation of the land. When some laws tried to solve this problem, they prevented people from disposing of their property [39], regarding Egyptian agricultural reform 1952. However, this research will eliminate all previous negatives and lapses, as modern ideas will not restrict the owner's freedom by forcing them to sell their land or give it up regardless of the size of the land. Then, integration between legal legislation and modern administrative tools should be created to achieve maximum effectiveness and sustainability.

Therefore, the source of primary legislation, the culture of the region, and the extent of the community's ability to apply those laws must be considered. Lawmakers should benefit from past experiences of Islamic legislation, which has succeeded in preserving agricultural lands throughout the ages. The Islamic solution is to implement the idea of the *waqf* (owning land) in large quantities without fragmentation and in legislating new laws that are compatible with the development of the times and avoiding the mistakes made by legislators. The development process remains integrative, and all efforts must be combined. For any project to succeed, ideas and efforts must be shared, and obstacles must be overcome.

5. Conclusion

The main purpose of this study is to explore a solution to the problem of agricultural land fragmentation, which is an important issue that should be studied in Islamic countries. The problem negatively affects the economies of these countries through low yields and poor production in general. This research explores solutions based on the principles of Islamic economics, highlighting *waqf*. This research focuses on studies that have addressed the topic of land fragmentation, benefiting from different points of view.

Using Islamic economics ideas to solve problems, especially the problem of land fragmentation, is a new research area. In a study conducted in Islamic contries, the research emphasized primarily the development of the *waqf*, and called on the government to develop the legal and administrative structure of the *waqf* [64].

To achieve the general development goals, the research seeks to implement the *waqf* proposal for the Indonesian Forest Strategy. This research did not address the problem of food security, production or yield, nor did it expand on the issue of land fragmentation. What concerns many countries is how to develop policies to reduce land fragmentation and preserve arable land *[65]*.

Another study focused on the conflict between Islamic and Indonesian laws and the exploitation of *waqf* lands. In this study, the function of *waqf* in preserving the land was not explored, although increasing production in *waqf* land management was studied. In addition, the research did not give legal recommendations for legislating non-fragmentation of land and increasing production *[66]*.

This study focuses on addressing the critical issue of agricultural land fragmentation in Islamic countries by drawing on the principles of Islamic economics. Central to its objective is the innovative application of the waqf system as a strategic solution to this urgent challenge. By blending traditional Islamic practices with modern agricultural and economic needs, the study aims to provide both practical and scientifically robust answers, fostering sustainable land management and strengthening the economies of Islamic nations.

Enhancing the value of *waqf* in the long term and highlighting its importance by presenting proposals to improve performance through governance, laws and management.

In order to increase yield and improve production quality to protect land from fragmentation, this research aims to provide creative solutions by integrating the principles of Islamic economics with modern economic processes. To achieve food security and economic stability in Islamic countries and unify their agricultural lands, this proposed approach combines legal frameworks, incentives and community participation to achieve the goal.

The waqf is inherently flexible, adapting to the prevailing corporate or governmental administrative system. As the *waqf* concept allows the donor to propose its management structure, waqf can serve as an economic nucleus supporting sustainable development.

Designating state and individual properties as *waqf* protects them from generational fragmentation. Lawmakers should pass measures to make *waqf* administrations more open and transparent and to make it easier for people to move around. Easy access to new subscribers, transparency, and accountability are all benefits of well-structured regulations for *waqf* management that inspire confidence and trust among prospective donors.

Legislators should introduce laws facilitating the establishment of joint-stock companies that combine waqf principles with agricultural cooperative models. These companies would address land fragmentation by pooling scattered plots while granting farmers ownership through shareholding. This structure allows farmers flexibility to sell, inherit, or transfer shares, ensuring individual rights without disrupting land unity. Additionally, these companies could foster collaborative farming practices, access to shared resources, and improved market opportunities. By integrating modern cooperative strategies with historical waqf traditions, this approach offers a forward-thinking solution to land fragmentation, addressing both economic and social challenges in sustainable ways. Modern shareholding principles perfectly harmonize with the structure of *waqf*, and this research will not only provide a pragmatic approach to land consolidation but also open up the labyrinth of Islamic inheritance laws. This model is representative of mingling ancient Islamic tenets with current economic practices, given emergent challenges in agriculture.

This study, while comprehensive, has limitations. The focus on Islamic countries may not encompass all global land fragmentation issues, necessitating further research across diverse legal and cultural contexts. Public policies must consider these diverse settings to effectively implement proposed corporation structures. For management, understanding the economic impact of *waqf* land development is crucial. Governance practices in *waqf* institutions should be enhanced to improve operational, financial, and monetary performance, thus increasing donor confidence and transparency. Comparative studies and pilot projects will provide valuable insights, aiding in the development of effective strategies for sustainable agriculture and land management.

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Appendix 2: Land ownership system in Iraq and the utilization of the Albanian experience

Land Ownership System in Iraq and the Utilization of the Albanian Experience

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Abstract

The obstacles that posed a serious threat to development in the Iraqi agricultural sector, the most prominent of which was the ownership system. By reforming the ownership system, investment increases are reflected in production and ensure sustainable development. Due to property conflicts and legal and political instability, Iraq faces significant challenges in achieving adequate rates of agricultural development. This qualitative study analyzes the roots of economic and legal policies related to the land ownership system. It uses extensive literature to provide a comprehensive view and find appropriate solutions. This study proposes broad reforms to property laws and tries to create a suitable investment environment to ensure fair distribution and increase production. The importance of this study lies in its comprehensive analysis of the historical and ideological changes that occurred in the agricultural ownership system. Albania has succeeded in achieving reasonable rates of development by increasing agricultural production after adopting a hybrid system that balances its support for the agricultural sector with privatization and the market system, through land ownership and conflict resolution. The study aims to benefit Iraq from this experience to achieve a balanced system that helps achieve development at good rates. Creating a system to solve the problem of ownership is what will help revive the Iraqi economy in the next stage. The study shows that deep economic and legal reforms, in addition to benefiting from experiences that have proven their ability to overcome many obstacles, would enhance agricultural production and improve food security.

Keywords: Agricultural Land Ownership, Agricultural Productivity, Sustainable Development, Economic Stability**,** Food Security.

1. Introduction

The Property Rights Theory provides a crucial framework for understanding the challenges that Iraq faces in land ownership. By following the principles of the theory and taking a cue from countries with similar problems, Iraq can formulate a system through which the land ownership problem can be solved in order to make progress towards sustainable agriculture. (Demsetz, 1967). Property system reforms in Iraq are a priority and are part of the comprehensive reform plans of successive governments. To achieve positive results, decision-makers should take serious steps to formulate laws that are compatible with the environment, society and the specific situation in Iraq, and take into account similar experiences (Coase, 1960).

Agricultural land is a very fundamental resource in all countries and cultures, especially Iraq, due to the fertility of its soil, the availability of water, and the suitable climate for growing

many crops. For these reasons, the land becomes more valuable for fertility and production diversity. The impact of political, social, and economic transformations on agricultural policies and ownership was great, which led to the diversity and overlap of laws and the emergence of thorny conflicts (Baali, 1969; Farouk-Sluglett & Sluglett, 1983). The weakness of the laws and policies that address this problem had a major negative impact because the laws and reforms were formal, political, or ideological (Hamoudi & Ayada, 2015). The complex ownership system in Iraq dose increased conflicts and reduced investment opportunities, which hinder economic development; this research aims to find effective reforms and policies to solve this problem.

Iraq's history has witnessed major political and social challenges in land ownership systems, from the Ottoman occupation to the present, which has directly affected the continuation of conflicts over ownership (Merebashvili & Dzamukashvili, 2024). The study attempts to explore the historical origins of ideological differences in ownership systems and investigate the political, legal, and economic factors that drive these systems. The study will draw on the Albanian experience, including developments after the Ottoman occupation, the transition to communism, and the subsequent transition to a market system, along with Albania's reforms to join the European Union (Ervis & Anxhela, 2024; Leka, 2016).

This study gains its importance by providing a deep understanding of agricultural land ownership systems, understanding the nature of land conflict, and also contributing to improving agricultural policies and enhancing food security in Iraq (Mustafa & Abdul-kareem, 1954).

The main research question: "How can production and investment be increased by creating a new policy for ownership systems?"

Albania's experience in dealing with this situation and achieving growth and investment rates, in addition to the similarity of the political history between Iraq and Albania, made it possible to study and benefit from it (Cungu & Swinnen, 1999). The fact that the two countries share similar political and social histories provides a good opportunity to study this problem and to use many Albanian tools that could be useful to Iraq (Tripp, 2007). Moreover, Albania has encountered economic challenges akin to those in Iraq, such as inadequate agricultural infrastructure and struggles in attracting investment. Therefore, its experience is especially pertinent for providing practical solutions (Williams, 2009).

The structure of this research consists of a set of sections that begin with the introduction that reviews the background of the events of the topic and a statement of the importance of the research, objectives, hypotheses, and scope of the research. Also, the introduction that

explains in detail the gaps in previous literature in agricultural systems and how this gap related to land ownership laws can be filled. The study presented a detailed analysis of the different policies and ideologies throughout history of different ownership systems and their impact on agriculture in Iraq and also in Albania according to historical eras and their ideological effects on production or conflict. The study presented the results and also recommendations for improving agricultural policies to achieve economic stability through food security.

2. Literature Review

The study reviews the land tenure and administration system in Iraq and provides a critical analysis and highlights the problems in the most complex legal frameworks and its beginnings in the Ottoman occupation. The study showed the nature of the central state, and despite its efforts to address the problems of ownership, it failed to address this situation. The study confirmed that the lack of flexibility of laws led to an increase in conflicts, which led to the weak performance of the agricultural sector as a whole. It recommends a more flexible and decentralized approach to managing and resolving local land disputes, which would ultimately improve agricultural productivity (L. H. Ossmi & Ahmed, 2017). The study criticizes the centralized land administration system, it would have been better if it had incorporated a comparative analysis with other countries that could further strengthen the argument in favor of the decentralization view by showing a broader set of outcomes and solutions applied in similar contexts.

This study suggests benefiting from other systems and countries that have transitioned from public ownership systems to free market systems. The study confirmed the success of some countries in enacting laws that helped them transition to private ownership with fewer problems. This situation helped in the transition to the private ownership system, which was a supportive environment for farmers and innovation by providing a safe environment for investment. The study indicates that Iraq can adopt and find some reforms to stabilize its agricultural sector, enhance production, and secure farmers' rights (Hamoudi & Ayada, 2015). The study highlights beneficial reforms from other countries but lacks a name for countries that Iraq should follow to implement its context. The study did not develop a detailed action plan to implement the Iraqi social and political context.

The study emphasized providing clear title deeds and a modern digital land registration system to protect property rights, encourage agricultural investment, and increase production. It indicates that all countries can greatly benefit from implementing similar laws and that integrating laws and registration with technology such as a digital land registry is required. Digital registration addresses the problems of administrative and financial corruption and

inefficiency that the current land administration system suffers from (Fabbri et al., 2022). The focus on digitalization's role in enhancing land registration is timely, yet the study could expand on the specific technologies that are most feasible for Iraq.

There are several reasons affecting the use of land in addition to the current ownership system. In recent years, the rate of unplanned urban expansion has increased on the outskirts of cities. From this side comes the encroachment of the city and residential buildings on agricultural lands. In Iraq, this has resulted in a significant deterioration in agricultural lands (Khudaeer, 2022). The failure to activate land use and ownership laws, the absence of supervision, and the weakness of urban planning, in addition to several other reasons, have made it difficult to manage and plan for lands in a sustainable manner.

These negatives have led many individuals to turn their agricultural lands into residential plots and sell them at exorbitant prices, without the attention of the concerned authorities. There is a great need to impose and enact laws to regulate land uses such as urban expansion trends and the preservation of agricultural land based on well-studied plans (Ahmed & Ahmed, 2021). Although this study emphasizes many gaps related to property legislation, urban expansion and the preservation of agricultural land, it does not specify clear recommendations to address the problem, so this study is insufficient to address the problem from a practical point of view.

Albania went through a transitional phase after the communist regime dominated the country for a long time, and some traces of this regime remained in the agricultural sector. After the 1990s and the liberation from the old regime, farmers still refrained from forming cooperatives and found it difficult to organize themselves by establishing agricultural associations and cooperatives, which helped them in finding inputs, marketing, consulting, etc. However, after the help and support of international organizations such as GIZ and FAO, it became easier to form associations and cooperatives. Generally, cooperatives proved successful in achieving high growth rates for the agricultural sector, increasing productivity, and enhancing farmers' access to markets. The study confirms that the effectiveness of these initiatives depends on the continuous support of international organizations and the government, in addition to following long-term strategies and increasing farmers' skills in managing their projects and cooperatives, which ensures their sustainability in Albania and enhances agricultural development (Sokoli & Doluschitz, 2021).

After reviewing the success of cooperatives in the study as a result of receiving support from international organizations, they failed to provide viable solutions to address the structural challenges in Albanian agriculture. In addition, the complete dependence on international

organizations for support gives a negative indication regarding their sustainability. While the study highlights the success of cooperatives after receiving international support, it fails to provide clear solutions to address local economic and structural challenges. In addition, the heavy reliance on external funding raises concerns about the long-term sustainability of these achievements if international support ceases.

Although local tribal law has a significant impact on resolving property disputes, the problem is its intersection with the official laws of the state. When laws intersect, it becomes difficult to resolve conflicts and they become thorny. The study suggests integrating tribal laws with official state laws. This could establish an approach that is more compatible with society and culture, thus enhancing property security and reducing conflict (Mélisande, 2021). Although the study criticized the overlap in-laws and the weakness of state law, it suggested integrating local tribal laws without providing clear solutions on how to accept enforceable laws that guarantee justice and sustainability.

The research explains the issue of gender discrimination in land ownership, that customary traditions in Iraq still grant privileges to male ownership, while restricting women's ownership of agricultural land. The study suggests the need to address this discrimination through awareness and the application of legal articles that urge equality, and this is necessary to guarantee women's rights and integrate them into participation in agricultural production (L. H. M. Ossmi, 2023).

It would have been better to provide solutions and recommendations for legal and cultural treatment to bridge the gender gap in land ownership, and it is preferable to make the development of this matter through policies adopted by the relevant institutions. The study focuses on the need to reform weaknesses in property laws and dispute resolution. The current problem is that the shortcomings of some laws lead to delay or unfairness to the parties to the dispute, and thus the research recommends the establishment of specialized courts in land and property disputes, and judges and lawyers should be trained on the laws that address these issues (Link, 2005). It is necessary to study the weaknesses of Iraqi laws and find solutions, but a comprehensive evaluation of the proposal for this court specialized in land affairs, and disputes must be made, and examples from other countries that have established similar courts will strengthen the basis of the proposal. This study focuses on a fundamental issue, which is the role of property rights in economic development, with a focus on securing land to enhance agricultural investment. The study found that insecure property rights are a constraint on growth. The research emphasizes that reforms aimed at securing property rights can greatly help in opening up a wide scope for the development of the sector and increasing production (USAID, 2018). The study mainly reviews the issues of displacement in conflicts and land rights but without a broad view of the data that would provide a complete picture of the issue.

The study shows that the lack of secure property rights in agricultural lands has significant adverse effects on development and the economy. The protection of property rights as stipulated in Article 23 of the Iraqi Constitution and disputes related to the subject of property in the disputed areas in the Iraqi central authority as well as the Kurdistan Region. It analyzes the difficulties that arise due to the insufficient implementation of Articles 140 and 136 (Kokha, 2023). The research includes the position of the Federal Supreme Court on these issues and proposes solutions to address the shortcomings in legislation and implementation in these areas. The study provides a good insight into the laws governing real estate in Iraq, particularly for individuals involved in transactions (Kokha, 2023). In addition, it would have been useful to incorporate comparisons with other countries' experiences to assess the effectiveness or ineffectiveness of land dispute resolution procedures in similar circumstances.

The studies reviewed consistently highlight the significant challenges facing the land tenure system in Iraq, which is considered the most pressing constraint on the development of the Iraqi agricultural sector. The gaps identified by the studies underscore the need for legal reforms and economic policies that guarantee farmers' rights, reduce land conflicts, and help achieve food security through development.

3.1. Property Rights Theory and Its Application to Agricultural Reform in Iraq

The concept of "property" embraces a variety of objects, rights, and interests. There are property rights in tangibles such as land and water, and in intangibles such as the performance of a professional singer (Lehmann et al.2020). Tangible things with which property rights can be linked in agriculture are land, rights to use land including the right to transfer land, farm improvements, and livestock (Moon et al., 2021). The reason for linking property rights to tangible things is that: (a) property rights allow the allocation of scarce resources such as land among competing users, and (b) the allocation roles refer to the management of physical items. In property rights literature, the departure for tangible things is to highlight the importance of rights to damage or injure other people's assets, rights to make other people afraid to act, rights to injure other people's income, etc (Gómez-Limón et al.2020).

However, property rights associated with land can be divided into at least four basic components: the right to transfer, the right to use, the right to use and keep the income for a period of time, and the right to manage and decide (Barzel & Allen, 2023). The concept of property rights extends to determinants of the four basic components of the right, or the

functions of the rights. Note that people may have certain determinants or functions of a property right independently of whether they possess the physical asset associated with this property right, jointly possess the asset, or use it (Dahlgren & Whitehead, 2021; Razali et al., 2020).

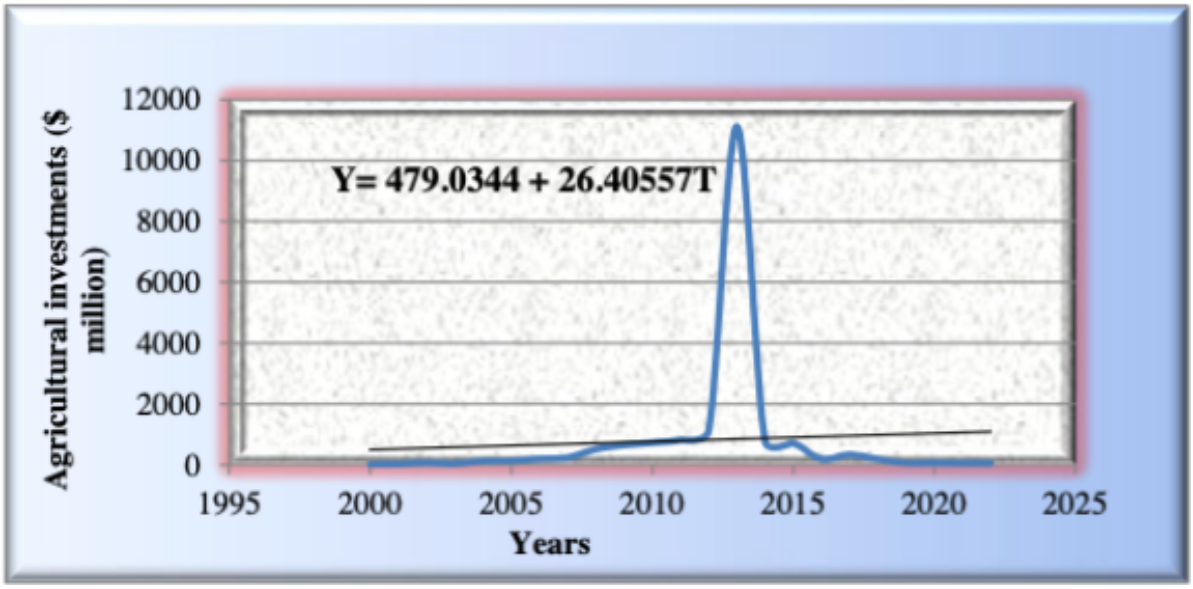
Consider a rural landlord with units of land who has the ability to observe the outputs produced or the rent the land would generate when combined with tenant inputs. At the same time, a tenant is able to perform labor or receive rent, but the tenant's productivity due to the use of land is unobserved by the landowner. The landowner and tenant make a prior agreement regarding the division of outputs generated through the labor of the tenant or rent (Moon et al.2020). While the landlord or tenant can place use rights in all three outputs, compensation for the agreement is the determinant of a relationship, assuming that production inputs are individually specific (Barzel & Allen, 2023). The tenant is responsible for input allocation if the landowner does not declare any rights to output. A landlord, therefore, will only establish production and also provide inputs needed to share one or more outputs. Because geographic limits, tenancy labor, and maintenance of land quality are mandates of the contract, it is enforceable (Musinguzi et al., 2021). Total production and land quality are limited when the tenant secures output, which restricts his choice of inputs, and the tenant underinvests in land quality. In conclusion, landowners have an incentive to establish a contractual relationship that will allow maximum production and maintenance of land compared with the establishment of a sharecropping relationship or lease to preserve land quality or share output (Juutinen et al., 2021).

One of the most complex problems that hinder production is the way land ownership laws are managed. Land ownership has been a major reason for hindering agricultural production in Iraq. Therefore, it is necessary to expand the search for methods that can help in finding a radical solution. The new Iraqi regime decreed massive agricultural reform as a restructuring of the indigenous society's most basic institution and natural way of life. The stated intention of the government is to increase food production and to eradicate what they describe as backward and impoverished characteristics of the traditional occupation (Csaki & Lerman, 2021). The old way of life, featuring a mixture of mercantilism and feudalism, became at best obsolete as urban standards of living became basic necessities. The government replaced the private owner with the small "private" holder who in turn is watched over by government agricultural bureaus. The government assigned land, water, crop preferences, prices, the bulk of the labor force, and agricultural capital (Macaulay, 2020).

Traditional agriculture, a private and individualistic enterprise with inherited title and survivorship rights firmly established, is now fragmented with the added security of state-leased rights. Labor utilized in excess of twelve million person-days per harvest season has been displaced by about 31,000 articulated trucks and trailers, each of which replaces plus or minus 1,000 man-days (Mookherjee et al., 2020). Presently estimated to move in excess of 20 million tons, these trucks destroy cultivated fields and fencerows. Fully one third of the forty or more types of plants utilized by these villagers disappears completely from their economy within a ten-year period after the establishment of government farming. Only government input factors in an import economy make it possible for the villagers to participate at all. The traditional economy had the capacity and need to produce far more food than it now does (Castel-Branco, 2021).

Property Rights Theory is a fundamental concept in institutional economics, emphasizing the importance of clearly defining and protecting property rights to ensure efficient resource allocation and stimulate economic growth. According to this theory, individuals and institutions are more likely to invest in and develop resources when their property rights are legally protected and well-defined. This is particularly evident in the agricultural sector, where secure and protected property rights encourage farmers to invest in land improvements, thereby increasing productivity and achieving sustainable development (Demsetz, 1967). Conversely, the lack of clarity in property rights or the presence of disputes over land ownership reduces the incentive to invest and increases the risks associated with agricultural activities, thus hindering economic and social development. Security of ownership plays a major role in stimulating investments (Coase, 1960). Increasing the confidence and security of investors encourages the formation of long-term projects that may be linked to other projects. Security of ownership is the greatest incentive to increase business and investments in the long term and vice versa (Libecap, 1989). This is what we can witness in Iraq, where uncertainty and increased conflicts have led to the deterioration of this sector and the weakness of local and foreign investments. The curve in Figure 1 illustrates the general level of agricultural investment in Iraq (Mohammad Shahab and Rahim, 2024). This creates an unstable agricultural environment that hinders efforts to achieve food security and sustainable development (Hashimi & Edwards, 1961).

Figure 1: The general trend of agricultural investments in Iraq for the period (2000-2022).



Source: Muhammad Shihab & Rahim (2024).

Albania has provided a model for property laws to effectively address conflicts. Land registration laws and systems were a crucial step towards increasing economic stability through increased investment in the agricultural sector (Cungu & Swinnen, 1999). The policies implemented in Albania were successful in reducing conflicts and significantly increasing agricultural production (Muller & Munroe, 2008). The laws and procedures created a reliable land administration system that can increase the security for insurance companies and banks to think more about stability and investment (Cungu & Swinnen, 2018). Therefore, based on property rights theory, developing the property system and learning from some experiences would be an effective solution. To achieve sustainable agricultural development, Iraq must prioritize reforms in property rights. These reforms should focus on developing a modern land registration system that relies on technology such as Geographic Information Systems (GIS) to ensure accuracy and transparency.

Historical Background and Ideological Influences on the Land Tenure and Property System in Iraq

During the Ottoman rule from 1534 to 1638, Iraq was governed by a hierarchical land tenure system centered on feudalism and central authority. During the early period of the Ottoman occupation of the country, the *Timar* system was implemented, which granted land as rewards to military leaders and elites in exchange for their service (Kawtharani, 2023). Under this system, peasants worked the land as peasants and soldiers during war, and had no property rights, with their produce largely taken as taxes and tributes by landlords and officials. This exploitation led to the backwardness of the agricultural sector and discouraged any long-term

investment in the land by those who worked it. Ottoman policies focused primarily on revenue extraction rather than agricultural improvement. Lack of investment in irrigation and infrastructure stagnated agricultural development, and local farmers remained poor and unable to produce at their optimum level (Karpat, 1972).

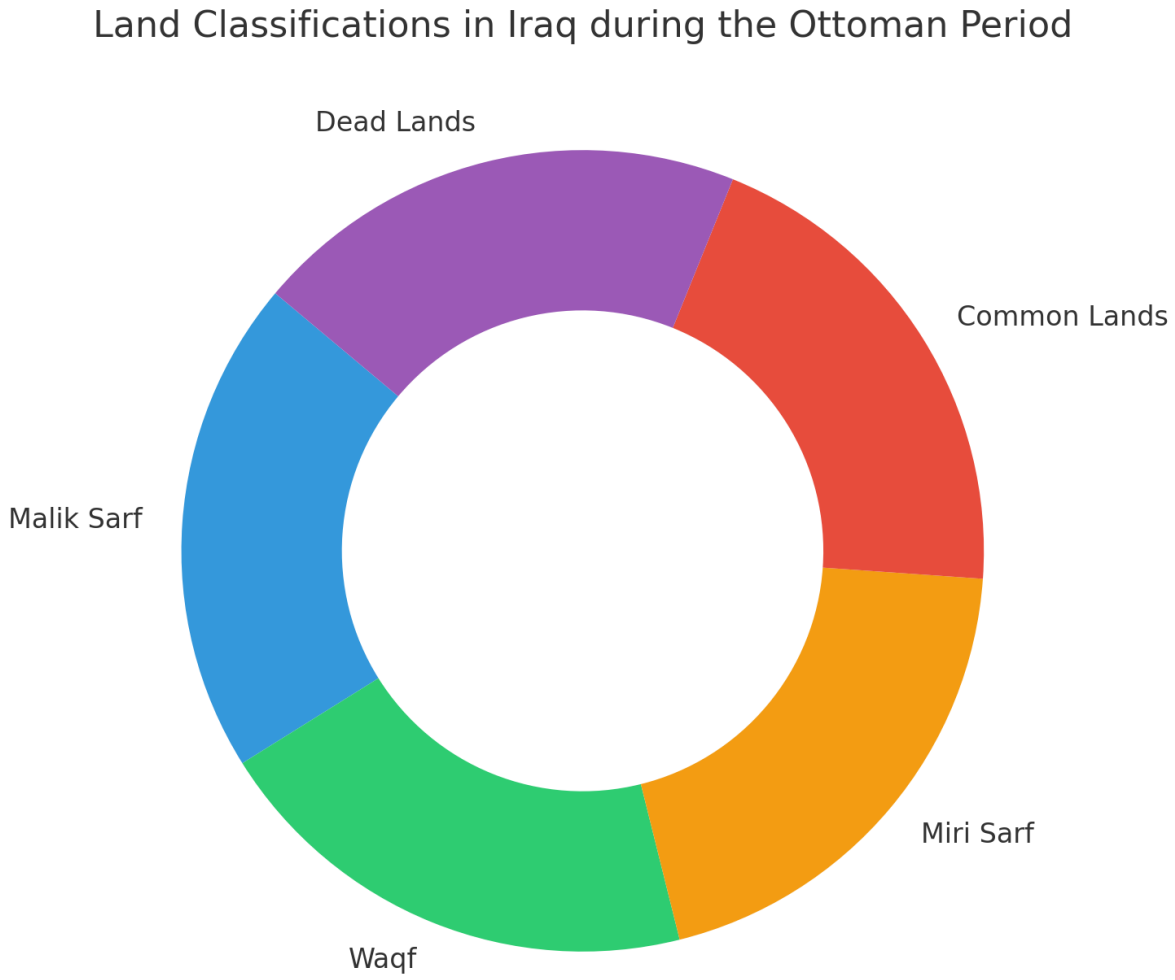
The second Ottoman era relied on tribal leaders rather than military leaders to exercise control over agriculture. Making sheikhs the feudal lords in this era made them exert all kinds of pressure on peasants to increase production, to meet the demand of the European market after the discovery of the steam engine and the second industrial revolution. These pressures created an environment of injustice, corruption, crime, inefficiency and rural backwardness. By the end of Ottoman rule, the agricultural sector in Iraq was characterized by widespread inequality, which paved the way for land reforms (Karpat, 1972; L. H. Ossmi & Ahmed, 2017). The Ottoman occupation left a legacy of deep-rooted economic and social conflicts and inequality in land ownership in Iraq, which had long-lasting effects on society and development. Inefficiency and social discrimination remained largely unaddressed until the establishment of the Iraqi state in the twentieth century (Kawtharani, 2023).

During the last Ottoman period 1868-1917, the Ottoman governor (governor) carried out agrarian reform in Iraq, and was the instigator of the Ottoman Land Law of 1858, which was an implementation of the *Tanzimat* reforms. This system relied heavily on tribal leaders to exercise control and pressure on peasants to increase production, to meet the increasing demand for agricultural goods in the new European market after the discovery of industrial machines. The great pressure on peasants created an environment of injustice, arbitrariness and inefficiency. The Ottoman government's plan to increase production for the agrarian reforms in 1868 required some decisions from; First, it was necessary to end the conflict over ownership between sheikhs and peasants, because the circles of conflict formed tensions in some areas, and this hindered production. Second, the Ottoman government saw the need to enhance the stability of the nomadic tribes, the tribes west of the Euphrates, which were unstable and also practiced robbery and internal wars, and this hindered the wheel of production. Third, the Ottoman government had to start building a new irrigation system. Canals were built to bring more people into agricultural life. It contributed to the stability of the nomadic tribes by providing water for agricultural lands and the cities of Najaf, part of Karbala and part of Babylon (Hamdani, 2011).

The percentage of nomads in Iraq was close to 50% at that time and then decreased to 19% in 1905 (Hamdani, 2011). Some nomadic tribes preferred a stable life dedicated to practicing agriculture to obtain a stable economic resource (Nawar, 1968). This stability for the nomadic

tribes was a guarantee of the presence of cheap farmers and even labor. Some tribal sheikhs wanted to settle on the land, especially after the emergence of land ownership owned by the sheikhs and the increase in profits gained from agriculture. The committee found that tribal stability provided a greater guarantee of income from taxes. But these tribes and sheikhs have become a burden on the law and democracy in recent years, even in other Arab regions (Tuastad, 2021). However, there may have been more excellent agricultural production and greater power through opening up to the world market (Ali, 1979). Changes in the administration organization made the Iraqi nomads more connected to the central government and indicated the end of the isolation they were in (Lutsky, 1971). The Land Law of 1858 classified agricultural land ownership in Iraq as follows: First, (*malik sarf*) private property (land owned by individuals) which was mostly owned by a few in Iraq (Murad, 1992). Second, (*waqf*); land owned or managed by a specific party, for example a Muslim religious council. Third, (*miri sarf*), *miri*; arable or cultivated land acquired for the state through confiscation of property due to the Islamic conquest (Murad, 1992). The tenant's rights to *miri* were confiscated if he failed to cultivate it. Fourth: *Miri* lands: These are lands that a person has acquired the right to own for the purpose of cultivating them, and he may request to purchase them and then own them. *Miri* lands constitute the largest part of land ownership in Iraq, and these lands can be converted by order of the Sultan into other things (depending on the type of public interest), such as real estate that benefits the entire community or as cemeteries, markets, lakes, or roads. Fourth: Common lands: These are public lands that have no owner. Fifth: Deadlands: These are barren lands that an individual can turn into property with the permission of the Sultan and buy from the state, as evidenced in Figure 2. By the end of Ottoman rule, the agricultural sector in Iraq was characterized by widespread inequality, which paved the way for land reforms (Karpat, 1972; L. H. Ossmi & Ahmed, 2017). The Ottoman era left a legacy of entrenched social and economic inequalities in land ownership, which had long-lasting effects on agricultural development in Iraq.

Figure 2: Land Classifications in Iraq during the Ottoman Period



Source: Authors' own elaboration based on Ossmi and Ahmed, (2017) and Karpat, (1972).

Here is the doughnut chart representing the different land classifications in Iraq during the Ottoman period.
Malik Sarf: Private property owned by individuals.
Waqf: Land owned or managed by a religious council.
Miri Sarf: Arable or cultivated land acquired by the state.
Common Lands: Public lands with no owner.
Dead Lands: Barren lands that could be developed into property with the Sultan's permission.

These disparities and inefficiencies remained largely unaddressed until the establishment of the Iraqi state in the twentieth century (Kawtharani, 2023). After the establishment of the Iraqi monarchy in 1921, the government's primary goal was to initiate agrarian reforms, and the government implemented various promises of legislation aimed at redistricting land and boosting agricultural production. The Agrarian Reform Law of 1932 was a prominent

example of reforms that aimed to break up large provinces and distribute them into smaller parcels (Kingston & Paul W. T., 2002).

The monarchy era from 1921 to 1958 was generally a prosperous time for Iraqi agriculture, marked by large investments in dams, irrigation canals, infrastructure, and advanced farming methods. The monarchy implemented large-scale irrigation initiatives in various regions of Iraq that increased the area of arable land and boosted agricultural productivity (Fayyad, 1963). Moreover, there were significant efforts to reform agricultural practices, which led to significant increases in production. However, the implementation of reforms was inconsistent, resulting in an uneven distribution of land, allowing wealthy and influential landowners to maintain a great deal of power and control. Despite these differences, the era was marked by relative stability and significant progress in agriculture (Eppel, 1998). Large disparities and conflicts over land ownership persisted despite the significant progress made by agricultural policies during the royal era in strategic projects that led to a significant increase in production. The failure to adequately address disparities in landowners' shares led to social and political unrest that reached its peak in 1958 (Alheis, 2011). There were other attempts following the 1958 revolution to reform the land through Law 30 of 1958, which aimed to redistribute large plots and divide them among landless peasants and impose restrictions on land ownership to ensure more equitable distribution, rural development and poverty alleviation (Baali, 1969). Despite these goals and the law's aim to achieve justice and increase production, the implementation of this law was hampered by a great deal of legal ambiguity. The resistance of the powerful landowners who still enjoy the same influence, always find devious ways to circumvent the law and maintain control by manipulating the articles and paragraphs (Farouk-Sluglett & Sluglett, 1983). This period saw the establishment of agricultural cooperatives to pool resources and increase efficiency (Hussein, 1958). However, these cooperatives failed due to political interference, corruption, and mismanagement.
The agricultural sector in Iraq suffered from inefficiency, corruption, and the diversion of resources towards military efforts, especially during the Iran-Iraq War of 1980–1988 and the Gulf War of 1990–1991. These conflicts depleted the agricultural sector, leading to dependence on imports and a significant decline in domestic food production (Nasrawi Abbas, 1994). The fall of the regime in 2003 marked the beginning of a new phase in Iraq's history, marked by attempts at economic liberalization amid political chaos.

The destruction of infrastructure, the displacement of rural populations, and ongoing conflicts severely limited any attempts to revive agriculture. Land tenure issues have been complicated by the return of tribal and sectarian rivalries, making it challenging to implement coherent

policies (Tai. K., 2010). The post-2003 era in Iraq has been marked by opportunities and challenges. While there is potential for significant growth in the agricultural sector, the absence of stable governance and a clear legal framework continues to hamper progress. Resolving land ownership disputes and creating incentives for investment in agriculture remain critical challenges for Iraq's development (Susanto et al., 2024).

3.2. Albanian Historical Background

The history of property rights in Albania is intricately connected to its political, social, and economic transformations. These transformations have spanned several distinct eras: The Ottoman period, the early 20th century (encompassing both Italian and German occupations), the communist period from 1945-1990, and the post-1990 period of transition toward a market economy and European integration. Each of these eras has played a crucial role in shaping the property rights framework in Albania (Leka, 2016). During the Ottoman period, Albania's land ownership system was deeply rooted in the feudal structure, known as the *Timar* system, which was prevalent across the Ottoman Empire (Malcolm, 2020). The military feudal system meant that agricultural land was allocated to military officers in exchange for their services, which meant that peasants had no property rights. The Ottoman regime retained control over land transactions, and agricultural land was rarely transferred to private ownership (Galgano, 2006). The Ottoman government's attempt to update the land ownership law in 1856 to allow individuals to register their private ownership was a good step, but the process was marred by corruption and land registration was only for the powerful and senior officials and the law remained unclear to the public.

The legacy of these policies laid the foundation for subsequent disputes over land ownership in all regions, as locals found their own laws to preserve some private land, and these laws played a role in preserving the rights of some, but not to the required level (Merebashvili & Dzamukashvili, 2024). Albania's independence in 1912 from Ottoman rule marked the beginning of a coherent national law, despite facing internal unrest and foreign occupations in the early years (Malcolm, 2020). The Land Code of 1925 and the Civil Code of 1929 marked the beginning of the country's legal path, the latter recognizing private property as sacred and inviolable, laying the foundation for modern property rights in Albania. However, the law limits ownership, aiming to balance individual rights with broader social objectives (Cungu & Swinnen, 1999). The Italian and later German occupations during World War II interrupted the development and enforcement of these property laws. The war and subsequent occupations caused widespread displacement and uncertainty over land ownership, as the legal system was unable to keep pace with the rapid changes and territorial shifts.

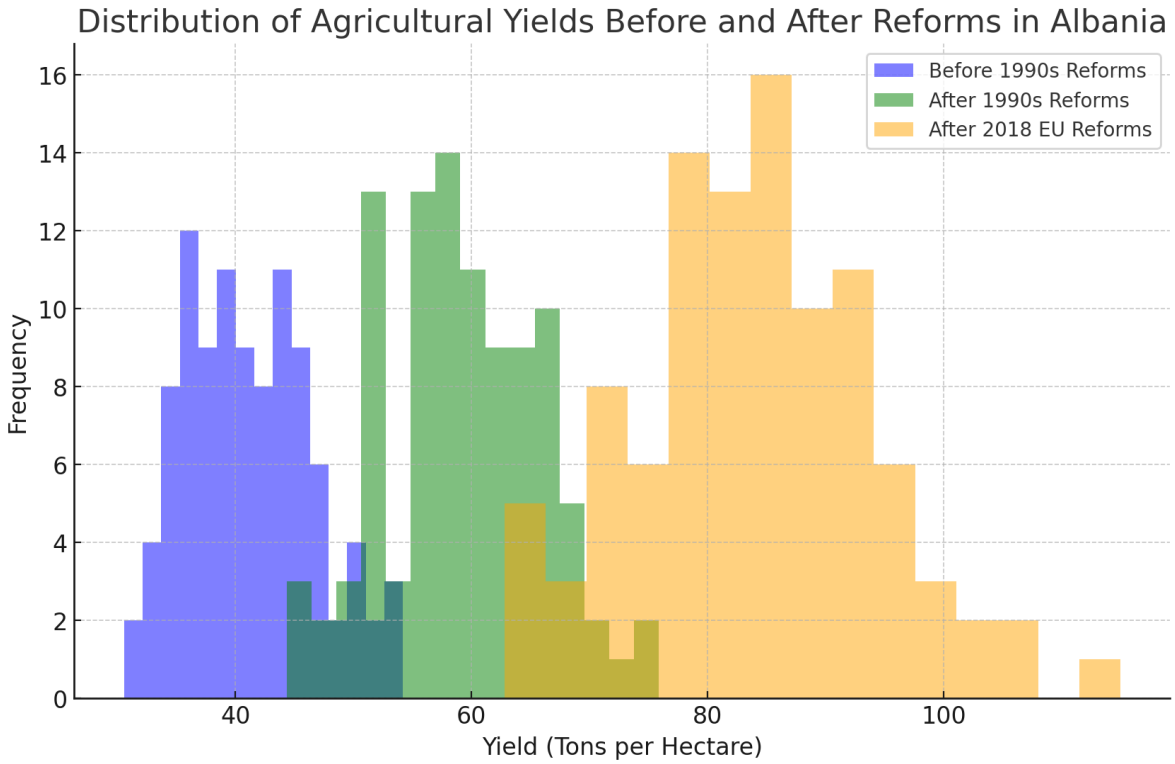
Additionally, the temporary nature of foreign rule meant that significant legal reforms were not implemented, leaving many of the pre-existing issues unresolved (Galgano, 2006). This period underscores how external pressures and occupation can disrupt the natural evolution of a legal system, leading to gaps that later governments would need to address. The challenges of this era set the stage for the radical changes that would come under the communist regime, where private property would be entirely abolished in favour of state ownership (Cungu & Swinnen, 2018). During the communist period, private property trends took a different direction from the property rights framework established by the laws of 1929. In 1945, with the establishment of the People's Republic, the state pursued a policy of complete national (Zhllima & Rama, 2013).

The state took control of all means of production and private property, whether agricultural or otherwise, was abolished. This was in the 1967 constitution, which enshrined the principle of state ownership of the means of production and prohibited all private economic activities outside state control. Instead of wealth and individual property, land and production resources were tools for achieving collective goals according to the transformation driven by the Marxist-Leninist ideological vision of a centrally planned economy (Doçe & Halili, 2021)state planning was dissolved and these policies had a significant impact. Collective farms replaced private farms, which led to the deterioration of the sector and a decline in production (Deininger, 2002). By the late 1980s, agricultural production had stagnated, contributing to the spread of economic crises. The state's tight control also stifled innovation and investment, as individuals had no incentive to improve land they did not own. Individuals had no incentive to develop land they did not own, and agricultural production declined in the 1980s (Konjo and Swynen, 2018). This era highlights the dangers of excessive state control and the abolition of private property rights. Recognizing private property again required a radical reform of the laws in Albania after the fall of the Soviet Union and the fall of communism. The 1991 Land Law was a pivotal piece of legislation that greatly facilitated the transfer of ownership from the state to individuals (Konjo and Swynen, 1999). In addition, this law was the first state recognition of private land ownership after the communist era (Konjo and Swynen, 2018).

The main driver of the new property rights reforms has been Albania's ambition to join the European Union. As part of the accession requirements, Albania must align its laws with EU standards, especially in property rights. One of the tools for resolving disputes has been a modern, high-tech land registry system, and considerable success has been achieved in modernizing the property registry system, to reduce disputes and improve transparency. The adoption of technologies such as geographic information systems (GIS) has played a major role in modernizing land records and ensuring accurate documentation (Cungu & Swinnen, 1999). The integration process also brought challenges, particularly in harmonizing the

diverse legal traditions that have affected property rights in Albania over the years. However, the adoption of EU-compliant property laws has increased legal certainty and attracted more foreign investment, contributing to economic growth (Susanto et al., 2024).

Figure 3: Distribution of Agricultural Yields before and after Reforms in Albania



Source: Authors' own elaboration based on Müller & Sikor (2006), Ervis & Anxhela (2024) and World Bank (2019).

Figure 3, above shows the distribution of agricultural yields in Albania across three distinct periods:

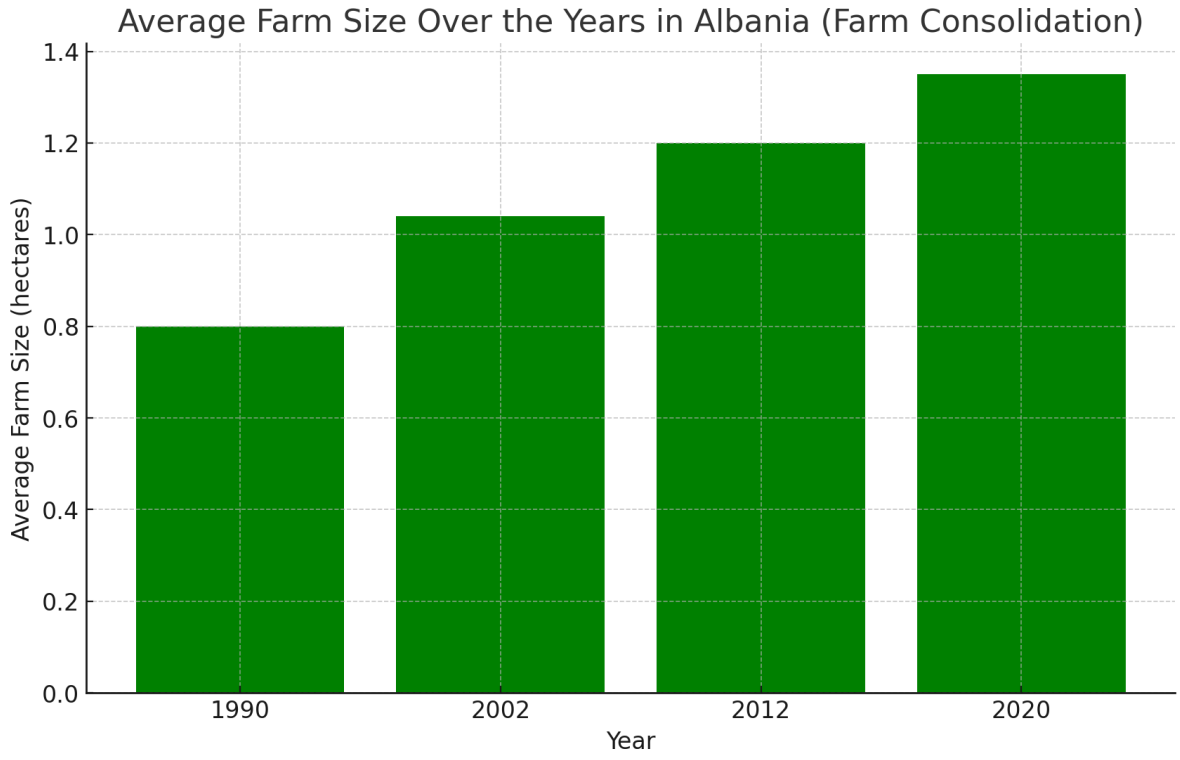
Before 1990s Reforms (in blue): Yields were generally lower, with most data points clustering around 35-45 tons per hectare.

After the 1990s Reforms (in green): yields improved noticeably, with most data points clustering around 55-65 tons per hectare (World Bank, 2019).

After 2018 EU Reforms (in orange): Yields increased significantly, with most data points now clustering around 75-90 tons per hectare, showing the substantial impact of reforms associated with Albania's integration into the European Union (Müller & Sikor, 2006). This visualization emphasizes the marked improvement in agricultural productivity in Albania following significant land reforms, particularly after preparing to join the EU.

These reforms have contributed to sustainable economic growth by attracting higher levels of domestic and foreign investment (Schmidt, 2023). By creating a more accurate and accessible high-tech registry, investors are making the process easier and thus increasing confidence in the property market. Consequently, positively affecting the land size, the investment projects started to collect the fragmented land to make the investment more beneficial by increasing the production, which will lead to an increase in the yield. Figure 4 shows the average farm size over the years in Albania, reflecting the trend of farm consolidation from 1990 to 2020 (Zhllima et al., 2021). The chart illustrates how farm sizes have gradually increased, indicating a consolidation of agricultural land over time.

Figure 4: Average Farm Size Over the Years in Albania (Farm Consolidation)



Source: Authors' own elaboration based on Zhllima, et al., (2021).

However, aligning Albania's property laws with EU standards has not been without challenges. One major challenge has been reconciling the diverse legal traditions that have influenced property rights in the country. For example, customary law, known as "*the qanun*," remains influential in some rural areas, where it often conflicts with formal legal principles. The law includes traditional rules relating to land ownership, inheritance and dispute resolution, which sometimes conflict with the principles set out in modern property law. Incorporating these customary practices into a unified legal framework that meets EU

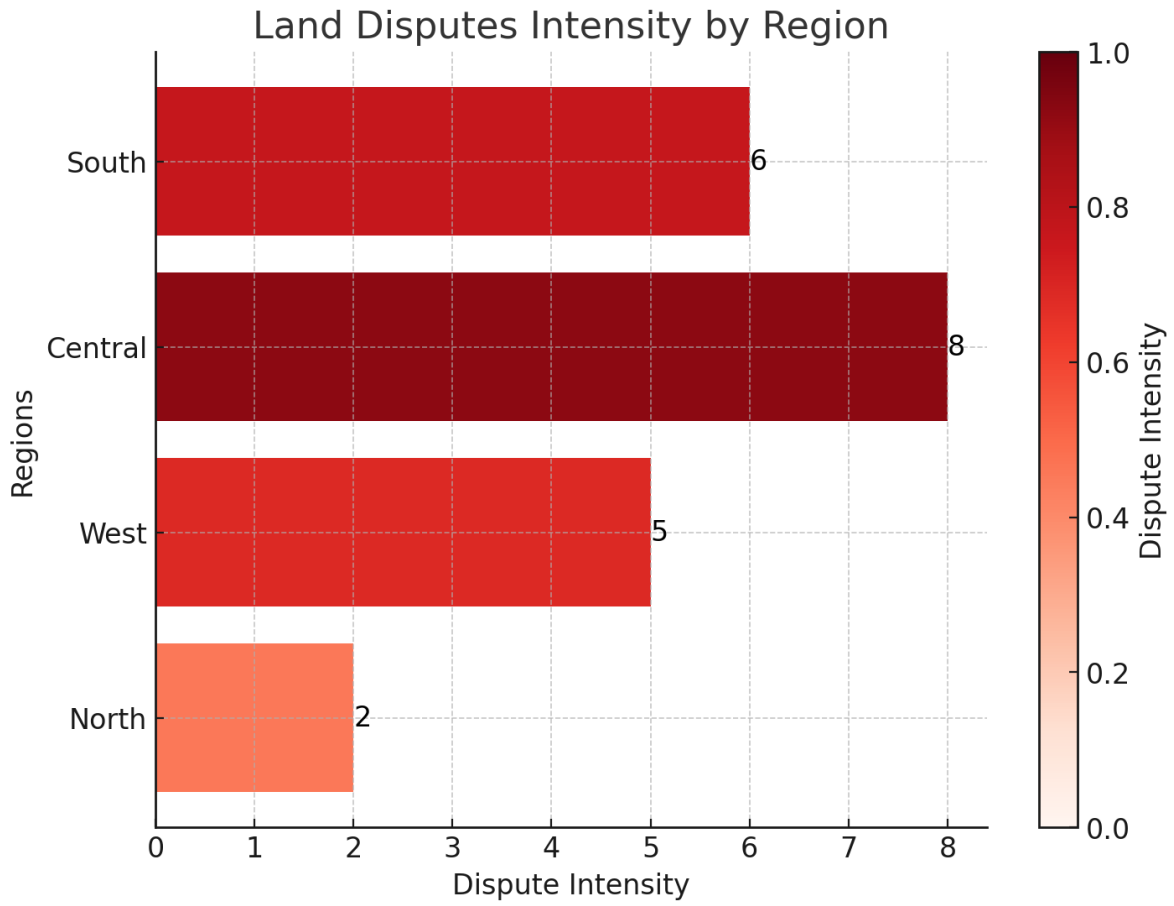
standards has been a complex and often controversial process (Ervis & Anxhela, 2024; Galgano, 2006).

4. Discussion

The significant similarity between the political and ideological history of Iraq and Albania would benefit development in Iraq. Studying Albania's logical solutions and laws for the property system may help to understand the roots of the problems and consider reforms that help Iraq develop and increase production (Muhammad Shihab & Rahim, 2024). The permanent conflict over property and the weak development of the Iraqi agricultural sector result from the negative historical, political, and social accumulations on the land ownership system. The success of Albania in relatively overcoming many of the problems of the transition from the socialist public property system to private property and the free market proves the effectiveness and success of its legal frameworks and its closeness to commitment to international standards (Cungu & Swinnen, 1999; Sokoli & Doluschitz, 2021). The study proved that the results are similar in the same direction to previous literature, which confirms that ensuring property security increases economic development and stability, enhances long-term investment and activates production programs (Galgano, 2006).

The conflicts over land in Iraq have led to stagnation in agricultural development. This variable was the most dangerous to production. Even with the availability of financing and labor, the problem of conflicts remains the most prominent and leads to limited investment and development. When comparing the results with previous studies, the findings align with existing literature emphasizing the role of secure land tenure in fostering agricultural investment and productivity. Studies by (Hamoudi & Ayada, 2015). support the notion that unresolved land disputes and fragmented ownership structures in Iraq have led to stagnation in agricultural development (Hashimi & Edwards, 1961). As evidenced in Figure 5, Land dispute intensity by region represents the level of land-related disputes across different regions in Iraq.

Figure 5: Land Disputes Intensity by Region in Iraq



Source: Authors' own elaboration based on Unruh, J. (2020), Hashimi R. and Edwards, A. (1961).

The numbers represent the intensity of land disputes: higher numbers indicate more disputes and lower numbers indicate fewer disputes in each region. By using color gradients, the map highlights areas with varying intensities of disputes, with darker shades indicating regions where disputes are more prevalent. For instance, the Central region shows the highest intensity of land conflicts, suggesting a need for targeted legal and administrative interventions in that area. This visualization helps policymakers quickly identify regions that require focused efforts to address land ownership issues and improve overall land governance.

Suitable land management and tight land information control significantly reduce collisions. highlight how digitalization in land registration in Albania played a crucial role in reducing corruption and enhancing transparency, a strategy that could be adopted in Iraq to address similar issues (Fabbri et al., 2022) In analyzing the results, it is evident that a key limitation in Iraq's land reforms is the lack of an integrated legal framework that considers the country's unique socio-political and cultural context. Unlike Albania, which successfully transitioned from collective to private land ownership, Iraq's attempts at reform have been hindered by

legal ambiguities, corruption, and political instability. The Iraqi government's efforts have often been fragmented, lacking the long-term vision needed to achieve sustainable agricultural development.

The discussion also underscores the need for specialized land courts to expedite dispute resolution, drawing from Albania's experience where streamlined legal processes have contributed to land tenure security. Despite the valuable lessons from Albania, it is essential to acknowledge the contextual differences between the two countries. Iraq's ongoing security issues, coupled with deep-seated sectarian conflicts, pose unique challenges that require tailored solutions. While Albania's post-socialist reforms provide a useful model, the Iraqi government must consider localized strategies that address the specific needs of its diverse population. This includes incorporating tribal leaders into formal land management processes and fostering community-based approaches to land reform. The study's findings have broad implications for policymakers in Iraq. By prioritizing legal reforms, enhancing transparency in land transactions, and providing targeted support for rural communities, the government can lay the foundation for a more stable and productive agricultural sector. Furthermore, the integration of digital tools in land registration, as demonstrated in Albania, could significantly reduce corruption and improve land governance in Iraq. Future research should focus on evaluating the effectiveness of ongoing reforms in Iraq's, more detailed case studies are needed.

5. Conclusion

In conclusion, the comparison between Iraq and Albania highlights the critical role of legal frameworks, government support, and stakeholder engagement in achieving sustainable land tenure systems. Albania's successful transition from a socialist land ownership model to a market-oriented system offers valuable lessons for Iraq, particularly in the areas of legal clarity, international cooperation, and community participation. By adopting best practices from Albania and adapting them to its unique context, Iraq has the potential to overcome its land tenure challenges and enhance agricultural productivity. The study concludes that Iraq's agricultural reforms should focus on establishing transparent property laws, ensuring equitable land distribution, and providing incentives for rural investment. Additionally, the integration of digital technologies in land registration, coupled with robust institutional support, is essential for creating a more secure and efficient land tenure system. While the challenges are significant, particularly in light of Iraq's complex socio-political landscape, the Albanian model provides a promising framework for reform. Finally, the research emphasizes the importance of long-term political commitment and the involvement of all stakeholders in

the reform process. Creating a good system and laws to protect holdings helps increase investment in the agricultural sector and also creates a cohesive social environment free from conflicts. The study recommends that Iraq focus on (1) enhancing the legal framework for land ownership to be more inclusive and transparent, (2) adopting a digital land registration system to reduce conflicts, and (3) establishing specialized courts for land-related disputes to ensure fairness and timely resolution.

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