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Challenges facing food security and agricultural development from an agricultural extension perspective

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Abstract

The problem of food security is considered one of the fundamental issues facing countries of the world in general and developing countries in particular, due to its direct connection with economic and social stability. This is clearly evident in Iraq and Arab countries despite the availability of natural and human resources. However, the weak efficiency in utilizing these natural and human resources, the recent decline in agricultural production, and the widening food gap, in addition to challenges represented by water scarcity, low efficiency of irrigation systems by farmers, rapid population growth, and the technological gap between scientific research and agricultural application, have all contributed to complicating food security problems. Agricultural development is the basic pillar for achieving food security and comprehensive economic development, which requires adopting clear strategies to advance the agricultural sector and increase its contribution to the gross domestic product. Hence, the role of agricultural extension emerges as a fundamental supporter of agricultural development, improving production practices, transferring modern technologies, and bridging the gap between scientific research and field application, which contributes to confronting existing challenges and enhancing food security in a sustainable manner.

Previous studies show that food security in Iraq represents a strategic issue in which structural, productive, environmental, and institutional challenges are intertwined, making its achievement require comprehensive treatments far from partial solutions. These studies have confirmed that the decline in the efficiency of the agricultural sector, the deterioration of water resources due to climate change and regional water policies, and the expansion of desertification collectively constitute major pressures that contribute to aggravating the food security gap. They also showed that the absence of integrated policies and weak institutional coordination may limit the state's ability to achieve sustainable development goals related to food security. In this context, agricultural extension is considered a pivotal tool through which agricultural production efficiency can be improved and decision-makers supported, but its role still faces organizational, technical, and human challenges that limit its effectiveness. Accordingly, addressing food security challenges in Iraq requires reactivating the agricultural extension system within an integrated strategic vision that supports agricultural development and enhances the ability to achieve food security.

Keywords: Food security, Agricultural development, Agricultural extension, Technology transfer

Introduction

The problem of food security is considered one of the intractable economic problems facing countries of the world at the present time, and achieving food security is considered one of the basic goals that all peoples of the world seek to reach in general and Iraq in particular (Rumaissa and Kholoud, 2022:1). Food security in the Arab world is also considered one of the main challenges, as despite the availability of natural resources of land, water, and human resources, Arab agriculture has not achieved the targeted increase in production to meet the demand for food (Reem, 2020:53). The inability to develop this sector leads to many potential risks, especially the difficulty of providing sufficient quantities of appropriate food for the population, in addition to exposing the country's food security to danger, which requires developing this sector and raising its contribution to the gross domestic product as it is one of the basic commodity sectors (Al-Hiyali, 2019:1). Agricultural development is the basic pillar and the first starting point for

the process of comprehensive economic development with a solid base in both developed and developing countries alike; therefore, it is the first starting point toward achieving an increasing growth in national economy rates, in addition to its important position when initiating any plan aimed at developing economic activity in any region of the world, as agricultural development aims to improve the management of natural and human resources in a manner that aims to develop the agricultural sector (Al-Saadi, 2020:1)^[4].

A group of factors and determinants control the quantities of agricultural production and the size of the food gap in Arab countries, represented by the small cultivated area, scarcity of water resources, low irrigation efficiency, and small area of irrigated lands. The agricultural sector also suffers from a "technological gap" represented by the failure of agricultural research outputs to meet the requirements of agricultural development, the increased demand for water in light of the growing needs for expansion in irrigated agriculture to achieve food security, rapid population

growth, and stimulating agricultural exports (Ibrahim, 2000-2014:68). The agricultural sector also plays a basic role in securing the issue of food security for the entire population; therefore, there should be a clear strategy for agricultural development (Bakhit *et al.*, 2023:7) ^[6]. In Iraq, the agricultural sector suffers from major problems and challenges, and the continuation of the situation as it is indicating the most important gaps facing agricultural policy in Iraq, which suffers from a food problem and ultimately negatively affects the consumer food basket. The most important challenges were represented by the inadequacy of local plant and animal production (Mohammed, 2016:205) ^[7]. In light of all these challenges facing food security and agricultural development, agricultural extension is considered a pivotal tool in supporting food security and agricultural development policies (Al-Najjar, 2025:2) ^[8]. Achieving food security is considered one of the main goals of achieving agricultural development, as it is one of the important issues facing countries of the world in general and developing countries in particular, including Iraq (Abdel Aal and Reesha, 2018:1) ^[23].

Agricultural extension constitutes the foundation and key to achieving agricultural and economic development, as agricultural extension helps correct wrong practices by farmers and protect public interest by providing information related to new technologies and better allocation of resources (Uddin, 2008:262) ^[27]. Therefore, agricultural extension is one of the organizations working in the field of agricultural development; rather, agricultural development is the goal of agricultural extension. The role played by agricultural extension in rural development can be summarized in the following aspects: helping to raise agricultural production efficiency, assisting in family income, contributing to rationalizing consumption patterns, contributing to guiding economic planning, assisting in training on agro-processing, contributing to confronting the population problem, contributing to preparing a society to create a strong push in economic growth, working to change farmers' attitudes and making them more receptive to scientific methods, contributing to human resource development, and contributing to the success of agricultural development (Al-Baali, 2019:374) ^[9]. Bridging the gap between scientific research and agricultural practice by ensuring farmers' access to changes in knowledge and innovations that enhance their agricultural performance (Bishnoi & others, 2024:68).

Therefore, the importance of this article comes from identifying the challenges facing food security and agricultural development from an extension perspective in Iraq, due to their great importance.

Objectives of the Article

1. Identifying the challenges facing food security and agricultural development from an extension perspective.
2. Identifying the role of agricultural extension in confronting challenges and improving food security and agricultural development.

Concept of Food Security

The concept of food security has received great attention since the Food and Agriculture Conference held in 1943, and since that time food security has been defined as

obtaining a sufficient and stable amount of food for each person (Abu Douh, 2024:2) ^[10]. The World Food Summit 1996 defined it as a condition in which all households are able to obtain, physically and economically, sufficient food for all their members, and there is nothing that threatens these households with losing their ability to obtain this food (Al-Shammari, 2022:68) ^[11]. Nimer and Shehata defined it as the natural and economic ability to obtain basic food needs, including food stability and individuals' ability to obtain it over time, and ensuring the availability of food materials permanently and continuously from local production for all members of society regardless of their living standards (Nimer and Shehata, 2022:76) ^[12]. Some link the concept of agricultural development with food security, as they see that food security represents the national political aspect of agricultural development and its goals, and it contributes to reducing the gap between demand for food products and production inputs and what is actually produced, in order to reduce dependence on the outside world in providing food needs, especially basic ones (Ibtisam, 2014:101).

Main Dimensions of Food Security

1. Increasing agricultural and food productivity in an efficient and sustainable way to provide food (supply side of food security), determined by the level of food production, stock levels, and trade (Yassin, 2015:2).
2. Access to food based on physical and economic access. Economic access is determined by available income, food prices, and availability of social support, while physical access is determined by infrastructure and its quality, including ports, roads, railways, communications, and food storage facilities (Ben Yezza, 2018:18) ^[14].
3. Proper utilization: adequate diet, clean water, sanitation facilities, and health care, which are necessary elements to achieve nutritional well-being of the population.
4. Stability: the necessity for individuals to have sufficient quantities of food at all levels and at all times (Qalloush, 2024:246) ^[13].

Challenges of Food Security and Agricultural Development

1. Social Challenges

Population growth is considered one of the challenges facing food security achievement because:

1. People are consumers of agricultural products which agriculture must primarily provide, and at the same time they are producers. Population growth has been mainly associated with their ability to invest available agricultural natural resources in food production, and with the growth of this ability, population increased and society flourished.
2. Migration from rural to urban areas increases the burden on agriculture due to changes in the type and pattern of required food.
3. The state, especially in developing countries including Iraq, deducts investments that could be directed to agricultural development to develop other sectors in light of increasing and multiple needs of the growing population.
4. Population increase places severe pressure on the

environment in general and the agricultural environment in particular (Yassin, 2015:8).

5. Advancing the Iraqi countryside and improving living standards of rural population and health services.
6. Reducing poverty rates in rural areas, especially for rural women.
7. Low educational level among many farmers.
8. Weak knowledge of modern technologies.

Social challenges also affect agricultural development through population growth and rural-urban migration, which directly impact the path of agricultural development, as they lead to increased food demand مقابل limited agricultural resources, which weakens the ability of the agricultural sector to achieve balance between production and consumption. Weak educational levels and lack of knowledge of modern technologies limit adoption of advanced agricultural methods and reduce efficiency of resource use, which negatively affects sustainability of agricultural development (Al-Mahdi *et al.*, 2021:1294).

2. Economic Challenges

1. Fragmentation of agricultural holdings.
2. Encroachment on agricultural lands.
3. High rates of loss in agricultural production.
4. Lack of competitiveness of agricultural products for increasing export rates, lack of encouragement and incentives for investments directed to agricultural development, lack of limits on importing basic food commodities, and lack of development of agricultural affiliation policies to keep pace with development in the current stage (Al-Mahdi *et al.*, 2021:1294).
5. High costs of agricultural production inputs.
6. Fluctuation of agricultural crop prices.
7. Weak agricultural infrastructure affecting farmers' production capacity.
8. Limited income for farmers.
9. Absence of sufficient investments in the agricultural sector.

Economic challenges of agricultural development are represented in fragmentation of holdings, high production input costs, and price fluctuations, which constitute a basic obstacle to achieving agricultural development, as they lead to decreased profitability and reduced farmers' ability to invest and expand production. Weak agricultural infrastructure and absence of sufficient investments limit development of agricultural value chains and reduce competitiveness of local products in local markets (FAO, 2022:10).

3. Environmental Challenges: including

1. Climate Change: Under prevailing dry conditions, severe water shortages, heavy reliance on rain-fed agriculture, and use of traditional systems in agricultural and food production in the Arab region, climate change is expected to have long-term negative effects on main economic sectors and on food security in the Arab region. Severe and repeated drought has already increased famine and food insecurity (Arab Organization for Agricultural Development, 2020-2030:30). It is one of the most important factors threatening food security globally and in

the Arab world. Effects of climate change on agriculture, livestock, and food sources include:

1. Reduced productivity of crops and food sources.
2. Changing geographical distribution of crops.
3. Irregular rainfall and increased desertification.
4. Increased water needs due to rising temperatures.
5. Higher temperatures increase soil erosion rates.

Thus, climate change in Iraq indicates that food security is more vulnerable to risk, and climate changes lead to reduced agricultural productivity, increased desertification risks, and water resource shortages, which hinder sustainable agricultural development, especially in dry and semi-dry environments. Irregular rainfall and rising temperatures impose additional pressures on traditional agricultural systems, increase production costs, and reduce stability of food production (Rumaissa and Kholoud, 2022:46).

2. Water Security: Water represents one of the most important basic components in providing food for countries, and it is primarily a political and security issue, as most countries seek to control water sources along with arable land in order to produce necessary food and meet basic needs of populations. There is a close and clear link between food security and water security, which are considered among national security priorities for countries regardless of their status or location, and they cannot be completely separated. When talking about food security, there is reference to a complete environmental system that needs study and analysis to determine best methods for managing what is available (Tawati, 2019:22). Currently, water storage volume is declining, which negatively affects performance of the agricultural sector. Decrease in plant and animal production is due to:

1. Drought and unfavorable climatic conditions.
2. Scarcity of water inflows in the Tigris and Euphrates and their tributaries.
3. Problems in management and operation of some dams.
4. Weak or absent water extension.

Water security is a basic element in achieving agricultural development, as scarcity of water resources and decline in storage negatively affect plant and animal production efficiency. Weak water management and absence of water extension contribute to increased water waste and reduced cultivated areas, which limits the agricultural sector's ability to meet food needs of the population, thus forming an obstacle to achieving agricultural development (Mohammed and Bahloul, 2025:17)^[20].

3. Desertification Problem (Al-Wandawi, 2010:154-155)

The Arab world in general and Iraq in particular have witnessed an increase in desertification due to overexploitation of natural resources, especially water resources, agricultural lands, forests, and rangelands, which have suffered for long periods from excessive misuse, in addition to ecosystem fragility, dominance of dry climate, and scarcity of agricultural water, which led to forest and rangeland degradation, reduced biodiversity, spread of soil erosion and degradation, and expansion of desertification to a level that warns of real danger.

Reasons contributing to desertification in addition to natural

climatic factors include:

1. Misuse of environmental resources causing degradation of natural vegetation cover due to overgrazing, deforestation, and mechanized agriculture especially in marginal areas, leading to desertification and desert encroachment.
2. Decrease in surface and groundwater resources due to uncalculated increase in groundwater extraction and not observing distances between wells.
3. Soil salinization due to excessive irrigation and poor drainage under dry climate conditions.
4. Unsound farm management and neglect of maintenance of water and land resources, and use of inappropriate agricultural techniques such as intensive and intermittent cultivation, improper use of chemical fertilizers and pesticides, and incorrect plowing.
5. Failure to treat lands contaminated by industrial, mining, and oil industry waste.
6. Intensified exploitation of environmental resources due to population pressure and change in consumption patterns, leading to soil exhaustion and rapid depletion of water resources, especially groundwater.

Desertification is considered one of the most dangerous environmental challenges facing agricultural development, due to land degradation and reduction of arable areas. Misuse of natural resources, soil salinization, and weak farm management accelerate desertification, leading to decreased agricultural production and threatening sustainability of resources, undermining long-term agricultural development efforts.

Previous Studies: Previous studies addressed challenges of food security and agricultural development, including studies by Al-Najjar (2025) ^[8], Al-Mahdi *et al.* (2021), Yassin (2015), and Al-Wandawi (2010). Reviewing these studies shows that food security has multiple dimensions and focused on major challenges hindering its achievement in Iraq. Al-Wandawi indicated that decline in agricultural sector efficiency, water resource crisis resulting from climate change and policies of riparian countries, and expansion of desertification are main factors negatively affecting food security in Iraq. Al-Mahdi *et al.* showed that food security is a multidimensional concept linked to economic, social, and institutional factors, and that current and future challenges may hinder achieving sustainable development goals related to food security by 2030 unless integrated policies are adopted. Yassin clarified that productive and structural obstacles contribute to increasing food insecurity in Iraq, limiting the agricultural sector's ability to meet increasing food needs. Al-Najjar emphasized importance of agricultural extension in supporting food security through developing extension programs, enhancing training and qualification, and increasing institutional and financial support, which raises efficiency of agricultural policies. Overall, these studies indicate that achieving food security requires comprehensive treatment of agricultural, environmental, and institutional challenges, with activation of agricultural extension as a basic tool and central **محور** in achieving food security and agricultural development, although it faces multiple challenges requiring organizational, technical, and human solutions by the Iraqi

government.

Role of Agricultural Extension in Achieving Food Security (Al-Khafaji, 2026:76-78): Agricultural development and thus food security cannot be achieved without activating the following roles of agricultural extension, derived from extension philosophy as an educational process in the first place, from which all expected roles emerge:

First - Dissemination and adoption of agricultural innovations and technologies: Dissemination of innovations among farmers and their adoption leads to optimal economic use of agricultural resources and raising production and productivity, thus modernizing agriculture. Agricultural extension plays the main role here due to its link with farmers' behavior.

Second - Activating the reciprocal relationship between agricultural extension and agricultural research: Agricultural research is the outcome of scientific research and the solid foundation of agricultural renaissance in any country, while extension is responsible for transferring research results to those who need to apply them, namely farmers.

Third - Supporting participation in building extension programs: There is increasing demand for involving farmers and opinion leaders in building extension programs in all stages, designing programs that fit real farmers' needs, and involving private sector and researchers, which benefits agricultural production and development.

Fourth - Promoting agro-processing and small agricultural projects: Agricultural sector in developing countries is among the most important economic sectors in absorbing labor, requiring continued provision of job opportunities. FAO report 2007 states that changes in food crop production strongly affect economic growth, poverty, and food security. Therefore, youth should be encouraged to implement productive projects through guidance and extension to exploit rural resources to increase production and meet growing needs.

Fifth - Reducing losses and rationalizing consumption: Many developing countries suffer losses up to 30% in crops and 20% in fruit production due to wrong practices and weak farmer capabilities. Agricultural extension can reduce losses through programs targeting behavioral change or introducing agro-processing and modern agricultural technology.

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