

Strengthening Wheat
Resilience in the CWANA
Region

Promoting Sustainable
Agriculture in Central
Asia through Biochar
Application

Integrating Modern
Technologies with
Khattarat System for
Water Management in the
Arab World

Regulatory Frameworks
and Policy Coherence in
Water Governance:



المنظمة الإسلامية للأمن الغذائي
Islamic Organization for Food Security
l'Organisation Islamique pour la Sécurité Alimentaire



July-August-September 2024 17th edition

FOOD SECURITY HUB



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CONTENT

Mrs. Makpal Bulatova

STRENGTHENING WHEAT RESILIENCE IN THE CWANA REGION: INSIGHTS FROM RECENT IOFS INITIATIVES

Mr. Bakytzhan Arystanbek

PROMOTING SUSTAINABLE AGRICULTURE IN CENTRAL ASIA THROUGH BIOCHAR APPLICATION

Dr. Abdelaziz Hajjaji

INTEGRATING MODERN TECHNOLOGIES WITH KHATTARAT SYSTEM FOR WATER MANAGEMENT IN THE ARAB WORLD

Ms. Amina Akhmetzhanova

REGULATORY FRAMEWORKS AND POLICY COHERENCE IN WATER GOVERNANCE: INSIGHTS FROM OIC COUNTRIES

Mr. Bolat Seisenov

THE VALUE OF EDILBAY SHEEP

Mr. Emre Yuksek

SUDAN'S FOOD INSECURITY CRISIS: THE IMPACT OF CONFLICT AND DISRUPTED LOCAL CEREAL VALUE CHAINS ON HUNGER

Mr. Azamat Khamiyev

UNLOCKING CAPITAL FOR AGRICULTURE: INNOVATIVE APPROACHES FOR SUSTAINABLE GROWTH

Dr. Shakhlo Atabaeva

TECHNOLOGICAL ADOPTION AND NATIONAL STRATEGIES FOR FOOD WASTE MANAGEMENT IN ARABIC-SPEAKING COUNTRIES

IOFS ACTIVITIES OVER JULY – AUGUST - SEPTEMBER



Dear Esteemed Readers,

Welcome to the 17th Edition of the Food Security Hub! Our journal is a curated collection of research, analysis, and recommendations on addressing food security within the Member States (MS) of the Organization of Islamic Cooperation (OIC). This collection also elaborates on the role of the Islamic Organization for Food Security (IOFS) in tackling these challenges.

In this edition, I invite you to explore our articles, which focus on innovative solutions and best practices to enhance food security across the OIC geography. Food security is a critical challenge in the Central and West Asia and North Africa (CWA-NA) region, where wheat production is substantial yet unable to meet demand due to low productivity and the effects of climate change. The first article highlights the importance of wheat as a staple crop, underscoring IOFS's efforts to promote the development of climate-resilient varieties through capacity building, technology transfer, and regional collaboration.

Additionally, we are addressing agricultural challenges through the introduction of sustainable practices such as biochar technology to improve soil health and water retention. The modernization of traditional water management systems and the establishment of stronger regulatory

frameworks are crucial for tackling water scarcity and ensuring sustainable agriculture across OIC MS.

Beyond crop and water management, advancements in animal husbandry, particularly in Kazakhstan's sheep breeding initiatives, are contributing to rural development and enhancing the global meat market. The IOFS is also committed to addressing food insecurity in conflict-affected areas like Sudan, where disrupted agricultural production has heightened hunger.

Furthermore, we explore innovative financial mechanisms, including Islamic finance and digital technologies, to attract investment in agriculture. Efforts to reduce food waste and loss through technological advancements are also crucial. Together, these initiatives form a comprehensive strategy to enhance food security, agricultural sustainability, and resilience in the region.

This quarter has seen significant milestones, including the landmark decision during the 50th Session of the OIC Council of Foreign Ministers in Yaoundé, Cameroon, to recognize December 11 as OIC Food Security Day. This decision symbolizes our collective commitment to combating food insecurity. At the invitation of the President of Kazakhstan, IOFS participated in the 24th Summit of

the Shanghai Cooperation Organization (SCO) in Kazakhstan, emphasizing the critical link between food security and regional stability. Additionally, we hosted the 16th UN-OIC Biennial General Coordination Meeting, gathering esteemed representatives from UN and OIC institutions to discuss sustainable development for MS. The 13th Executive Board Meeting of the IOFS convened, focusing on key strategies for bolstering food security within the Islamic world. Our Program Managers also hosted several training and capacity-building events in collaboration with leading research institutes and experts in Benin, Egypt, Kazakhstan, Nigeria, Uganda and Uzbekistan.

In conclusion, I extend my heartfelt gratitude to our Member States, partners, and stakeholders for their unwavering support and collaboration. I hope this edition stimulates intellectual discussions and solutions in the realm of agriculture and sustainable development. Your feedback and contributions are highly welcomed as we collectively work toward a future where food security is a reality for all.

Sincerely,

Amb. Berik Aryn

Director General
Islamic Organization for Food Security

STRENGTHENING WHEAT RESILIENCE IN THE CWANA REGION: INSIGHTS FROM RECENT IOFS INITIATIVES



MRS. MAKPAL BULATOVA

Manager of Programs and Projects Department Islamic Organization for Food Security

INTRODUCTION

Background and Challenges

Wheat, a vital staple, is intricately intertwined with the cultural heritage and economic foundation of the Central and West Asia and North Africa (CWANA) region. The CWANA region spans a vast geographic area, stretching from the Atlas Mountains in Morocco in the west to the fertile, irrigated Indus Valley in Pakistan in the east, and from the highland, high-rainfall areas of Ethiopia in the south to the temperate, arid landscapes of northern Kazakhstan. This expansive region naturally exhibits significant variations in agroecology, farming systems, moisture levels, temperature, soil types, and cultural practices.

According to FAO STAT (2022), the CWANA region produces more than 90 million tons of wheat on a total harvested area of 48 million hectares at an average productivity level of 2.5 t/ha, which is less than the world's average (3 t/ha). Wheat imports in CWANA countries in 2022 reached 98 million tons, while exports did not exceed 20 million tons. Among this region, countries such as Pakistan (26 million), Turkiye (20 million), Kazakhstan (16 million), and Iran (10 million) are still the major wheat producers in the world. However, despite their significant production volumes, these countries are achieving this with relatively low productivity, averaging around 2 tons per hectare. This lower yield is compensated by the large areas of land dedicated to wheat cultivation, which allows them to meet their domestic requirements and contribute to global supplies.

As part of the CWANA region, countries of North Africa like Algeria, Egypt, Morocco, Tunisia, and Libya are major importers totaling 25 million tons in 2022. Their combined production stood at 17 million tons. These countries also have high wheat consumption, averaging 167 kg per capita annually. It should be noted that Egypt leads the region with nearly 10 million tons of production and the highest yield of 7 tons per hectare. With its high wheat productivity, advanced agricultural practices, and strategic investments make it a potential leader in driving regional wheat self-sufficiency, as well as promoting knowledge transfer and capacity-building across member states, particularly in North Africa and the Middle East.

While the CWANA region is united by its reliance on wheat as a staple crop, the varying needs and capacities of its countries

highlight both challenges and opportunities. This contrast underscores the region's diverse agricultural landscape, where some countries struggle with low productivity while others face dependency on external sources for food security. This diversity also presents opportunities for growth and collaboration.

In addition, the region faces significant challenges in producing enough food to nourish one of the fastest-growing populations in the world, exacerbated by the impacts of climate change. Climate change is not a distant threat but a present reality that intensifies drought, increases heat stress, and disrupts the delicate balance of ecosystems. Farmers in the region, already struggling with pest infestations and crop diseases, now contend with the added burden of unpredictable weather patterns. Limited access to modern agricultural technologies further complicates these challenges, underscoring the need for a coordinated and comprehensive response.

The Islamic Organization for Food Security (IOFS) has recognized these varying needs and has strategically focused its Wheat Development Program on bridging the gaps. Through targeted efforts, IOFS is working to turn the region's challenges into opportunities for sustainable agricultural development.

A STRATEGIC FOCUS ON WHEAT DEVELOPMENT

At the heart of the IOFS, the Wheat Development Program is a clear understanding of the urgent need to address the pressing challenges in wheat production across the CWANA region.

The IOFS has identified capacity building, technology transfer, and the promotion of collaborative research as critical pillars of its strategy. By fostering resilience through these avenues, the program aims to develop wheat varieties that can thrive under the region's challenging conditions, ensuring that the lifeblood of the CWANA region's agriculture remains strong.

1. EMPOWERING FARMERS AND SCIENTISTS THROUGH CAPACITY BUILDING

In the face of adversity, knowledge is power. Recognizing this, the IOFS has organized several hands-on training workshops that have left a lasting impact on the region's wheat breeders, agronomists, and researchers. These workshops, held in key countries like Pakistan, Kazakhstan, and Uzbekistan, have pro-

vided participants with the skills and knowledge needed to push the boundaries of traditional wheat breeding.

0.1. In February 2024, prior to the mission to Pakistan, the IOFS initiated a consultative group and organized a **Webinar** focused on the **Development of a Material Transfer Agreement for Wheat Germplasm Exchange**. This webinar brought together scientists and breeders from across the CWANA region, including participants from Kazakhstan, Tunisia, Uzbekistan, Tajikistan, Pakistan, Jordan, Libya, Egypt, Iraq, Turkiye, and Afghanistan. The primary objective was to discuss and establish a robust framework for the exchange of wheat germplasm among OIC member states, addressing key issues such as phytosanitary regulations, legal barriers, and sustainable mechanisms for equitable genetic resource exchange. The meeting successfully led to the creation of a common framework for germplasm sharing and enhanced collaboration between breeders and plant genetic resources specialists, an effort that the IOFS continues to actively develop.

✓ In February 2024, IOFS conducted two important programs for CWANA wheat experts in Pakistan, collaborating with top agricultural universities in Faisalabad and Multan to drive advancements in wheat research and cultivation:

0.2. The International Conference on Emerging Technologies for Crop Improvement, held in Faisalabad from February 19-20, 2024, in collaboration with the University of Agriculture Faisalabad, CIMMYT, the University of Sydney, and the University of Melbourne. This conference brought together experts, researchers, and policymakers to discuss cutting-edge advancements in precision agriculture, genomics, and biofortification. The conference served as a critical platform for advancing agricultural innovation, bringing together leading experts, researchers, and policymakers to discuss the latest advancements in crop improvement technologies, including precision agriculture, genomics, and biofortification. The discussions highlighted the importance of emerging technologies in enhancing crop productivity, sustainability, and resilience in the face of climate change and resource constraints.

0.3. Exchange Visit and Hands-On Training in Pakistan on hybrid wheat technology focused on advanced wheat breeding technologies, agronomic strategies, and extension services for participants from various OIC member states. Participants in the training explored hybrid wheat breeding techniques, agronomic best practices, and seed production systems, with hands-on sessions covering hybrid seed production, sowing geometry, and color sorting for seed purity. Field visits to seed farms provided practical exposure to advanced agronomic practices. The training introduced innovative methods in hybrid wheat breeding and emphasized mechanization to boost productivity. Experts from Kazakhstan, Tunisia, Uzbekistan, Tajikistan, Libya, Egypt, and Iraq, along with local specialists from the Pakistan Agricultural Research Council (PARC), the University of Agriculture Faisalabad, MNS University Multan, and ACIAR, collaborated to facilitate a rich exchange of knowledge and resources. **As a result of this training, participants returned to their respective countries equipped with hybrid wheat seeds and the expertise to implement these technologies locally.**

0.4. Webinar on the Significance of Phenology and Floral Biology in Hybrid Wheat Breeding. The following activity was dedicated to the importance of phenology and floral biology in hybrid wheat breeding. This webinar was a follow-up to the mission in Pakistan, where hybrid wheat seeds were distributed to experts from OIC member states. The webinar covered critical topics such as the development of heterotic pools, crucial phenological stages, floral biology, and the impact of environmental factors like wind direction during pollination. The experts engaged in discussions to enhance their understanding of hybrid wheat breeding and its implications for yield improvement and resilience.

2. ADVANCING SEED INNOVATION AND AGRICULTURAL COLLABORATION IN CENTRAL ASIA

After the introduction with the new technologies from Pakistan, the IOFS launched a training workshop for Central Asian countries, specifically to **Uzbekistan, Tajikistan and Kazakhstan**, titled **"Seeds of Tomorrow: Innovations Testing for Resilient Ag-**





riculture in Central Asia” to continue promoting the knowledge and enhancing the awareness on seed health and quality with advanced training in seed testing methods, including visual examinations and DNA probes.

Uzbekistan:

2.1. In May 2024, In Partnership with the Ministry of Agriculture of the Republic of Uzbekistan and the Southern Agricultural Scientific Research Institute in **Karshi, Uzbekistan**, the IOFS conducted a training workshop on “Seeds of Tomorrow.” The workshop successfully equipped 20 local breeders and farmers with essential skills in modern seed testing, fos-



tering regional collaboration and laying the groundwork for sustainable agricultural development across Central Asia.

2.2. Following this, IOFS co-organized an **International Conference in Karshi on “Prospects for the effective use of genetic resources and crops and the use of modern advanced cultivation technologies in ensuring food security”**. This conference brought together agricultural researchers, policymakers, and practitioners to exchange knowledge and develop practical recommendations for improving agricul-



tural practices across the region. It emphasized the critical need for regional cooperation and the adoption of advanced agricultural practices, fostering partnerships that will drive future initiatives aimed at enhancing crop resilience.

These two activities were strategically aligned to address food security challenges in the region. The workshop provided hands-on training in seed health, while the conference broadened the focus to include genetic resources and cultivation technologies, creating a comprehensive approach to improving agricultural resilience in Uzbekistan and beyond.

3. ADVANCING WHEAT GENETICS AND BREEDING TECHNIQUES

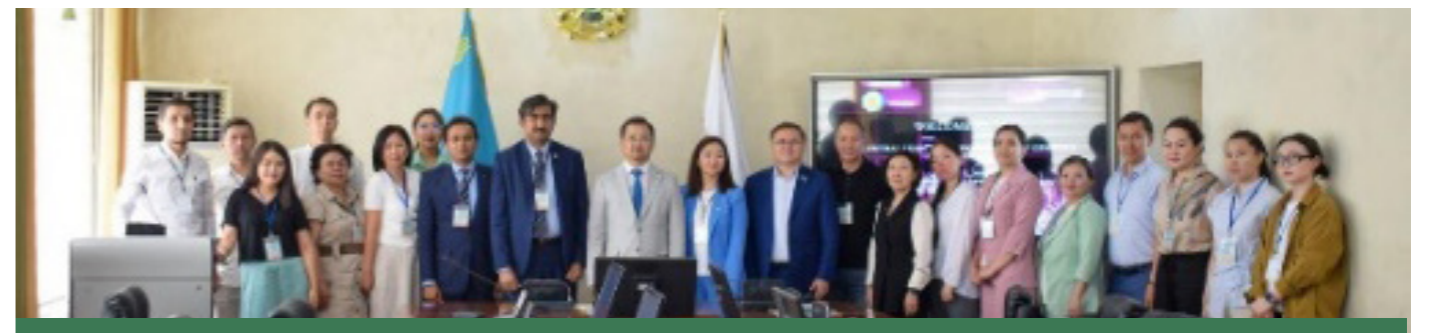
Kazakhstan:

3.1. In June 2024, IOFS within the “Seeds of Tomorrow” conducted training in Almaty and Taldyqorgan, Kazakhstan on



enhancing seed systems and introducing innovative testing methods tailored to improve the quality and resilience of wheat seeds produced in Kazakhstan. This initiative complemented the following genetics and genomics workshop by ensuring that the breeding and development of new wheat varieties are supported by robust seed systems.

3.2. In the same time period, in collaboration with Zhetysu University, organized the **2nd Central Asian Workshop on Wheat Genetics and Genomics** in Taldyqorgan, Kazakhstan. This workshop aimed to enhance the skills of local wheat breeders, scientists, and geneticists through comprehensive training on advanced breeding techniques, including hy-



IOFS has prioritized the development of climate-resilient wheat varieties through advanced breeding techniques such as hybrid and speed breeding. Hybrid breeding produces climate-resilient high-yielding varieties while speed breeding shortens breeding cycles, ensuring the region’s wheat supply for the future. Additionally, the IOFS’s focus on seed quality assurance equips farmers with the best tools to face these challenges.

The IOFS Wheat Development Program has already laid a strong foundation by emphasizing capacity building, technology transfer, and regional collaboration. Through initiatives in Pakistan, Uzbekistan, and Kazakhstan, local scientists, breeders, and farmers have gained the knowledge and tools necessary to



brid wheat breeding, speed breeding, and GGEBiplot data analysis, as well as hands-on experience in using KASP genotyping for precise genetic analysis. Resource persons included the IOFS Director of Programs and Projects, a noted wheat breeder, alongside experts from Çukurova University, Türkiye, and the National Agricultural Research Centre, Pakistan. They shared expertise on enhancing wheat resilience through genetic diversity, focusing on drought and salinity tolerance, and introduced speed breeding techniques to accelerate the development of climate-resilient wheat varieties.

A Promising Path Forward

The CWANA region faces complex challenges in wheat production, with climate change, soil degradation, and water scarcity threatening crop yields and making traditional farming practices increasingly unsustainable. To address these issues, the

improve wheat resilience and productivity. Building on these successes, the IOFS is planning to launch a comprehensive program in 2025 specifically tailored for North African countries. This initiative will introduce advanced agricultural technologies, innovative breeding techniques, and sustainable practices to the region, addressing its high wheat consumption, dependence on imports, and vulnerability to climate change. By continuing to emphasize collaboration, knowledge sharing, and the adoption of cutting-edge technologies, the IOFS aims to transform these initial successes into lasting improvements in food security and agricultural resilience across the entire CWANA region, with a special focus on the urgent needs of North Africa.

EN SUMMARY

Wheat, a vital staple crop, is central to the cultural and economic landscape of the Central and West Asia and North Africa (CWANA) region. The CWANA region, which spans from Morocco to Pakistan, produces over 90 million tons of wheat annually on 48 million hectares of land, with an average productivity of 2.5 tons per hectare—significantly lower than the global average of 3 tons per hectare. Despite this substantial production, the region remains heavily reliant on imports, with wheat imports reaching 98 million tons in 2022, while exports were limited to just 20 million tons. This imbalance is further exacerbated by the adverse impacts of climate change, such as rising temperatures and erratic rainfall, highlighting the urgent need to identify and introduce the most suitable wheat varieties within the region. Consequently, the exchange of genetic materials is crucial for the development of new, resilient varieties that can effectively address the challenges posed by climate change. In response, the Islamic Organization for Food Security (IOFS) within the OIC Strategic

Commodities Program, Wheat Development makes efforts on capacity building, technology transfer, and fostering regional collaboration. Key initiatives, such as hands-on training workshops in Pakistan, Uzbekistan, and Kazakhstan, have empowered local scientists, breeders, and farmers with advanced skills in wheat breeding and agronomic practices. The program emphasizes the development of climate-resilient wheat varieties through techniques like hybrid and speed breeding and ensures seed quality through rigorous testing methods. Building on these efforts, IOFS plans to launch a comprehensive program in 2025 specifically targeting North African countries, aiming to enhance wheat productivity, look into policy framework, address the needs and challenges, and the region's resilience against climate change. This initiative represents a critical step toward achieving long-term food security and sustainable agricultural development across the CWANA region.

FR RÉSUMÉ

Le blé, culture de base vitale, est au cœur du paysage culturel et économique de la région Asie centrale, Asie de l'Ouest et Afrique du Nord (CWANA). Cette région, qui s'étend du Maroc au Pakistan, produit plus de 90 millions de tonnes de blé annuellement sur 48 millions d'hectares, avec une productivité moyenne de 2,5 tonnes par hectare, nettement inférieure à la moyenne mondiale de 3 tonnes par hectare. Malgré cette production substantielle, la région reste fortement dépendante des importations, avec des importations de blé atteignant 98 millions de tonnes en 2022, tandis que les exportations étaient limitées à seulement 20 millions de tonnes. Ce déséquilibre est aggravé par les impacts négatifs du changement climatique, tels que l'augmentation des températures et les précipitations erratiques, soulignant la nécessité urgente d'identifier et d'introduire les variétés de blé les plus adaptées à la région. Par conséquent, l'échange de matériel génétique est crucial pour le développement de nouvelles variétés résilientes capables de relever les défis posés par le changement climatique. En réponse, l'Organisation Islamique pour la Sécurité Alimentaire (l'IOFS), dans le cadre du Programme

des Produits Stratégiques de l'OIC, Développement du Blé, s'efforce de renforcer les capacités, de transférer des technologies et de promouvoir la collaboration régionale. Les initiatives clés, telles que les ateliers de formation pratiques au Pakistan, en Ouzbékistan et au Kazakhstan, ont permis aux scientifiques locaux, aux sélectionneurs et aux agriculteurs d'acquérir des compétences avancées en sélection du blé et en pratiques agronomiques. Le programme met l'accent sur le développement de variétés de blé résilientes au climat à travers des techniques telles que la sélection hybride et rapide, et assure la qualité des semences grâce à des méthodes de test rigoureuses. S'appuyant sur ces efforts, l'IOFS prévoit de lancer un programme complet en 2025, ciblant spécifiquement les pays d'Afrique du Nord, avec pour objectif d'améliorer la productivité du blé, d'examiner les cadres politiques, de répondre aux besoins et défis et de renforcer la résilience de la région face au changement climatique. Cette initiative représente un pas crucial vers l'atteinte de la sécurité alimentaire à long terme et le développement agricole durable à travers la région CWANA.

ملخص AR

خلال بناء القدرات، ونقل التكنولوجيا، وتعزيز التعاون الإقليمي. وقد ساهمت المبادرات الرئيسية، مثل ورش التدريب العملي في باكستان وأوزبكستان وكازاخستان، في تمكين العلماء والمربين والمزارعين المحليين بمهارات متقدمة في تربية القمح والممارسات الزراعية. يركز البرنامج على تطوير أصناف قمح مقاومة لآثار تغير المناخ باستخدام تقنيات مثل التهجين والتكاثر السريع، مع ضمان جودة البذور من خلال أساليب اختبار صارمة.

وبناءً على هذه الجهود، تخطط IOFS لإطلاق برنامج شامل في عام 2025 يستهدف بشكل خاص دول شمال إفريقيا، بهدف تحسين إنتاجية القمح، واستكشاف الإطار السياسي، ومعالجة الاحتياجات والتحديات، وزيادة مرونة المنطقة في مواجهة تغير المناخ. يمثل هذا المشروع خطوة مهمة نحو تحقيق الأمن الغذائي طويل الأمد والتنمية الزراعية المستدامة في منطقة CWANA.

يعتبر القمح محصولاً أساسياً ذا أهمية مركزية في المشهدين الثقافي والاقتصادي لمنطقة آسيا الوسطى وغرب آسيا وشمال إفريقيا. (CWA-NA) تنتج هذه المنطقة، التي تمتد من المغرب إلى باكستان، أكثر من 90 مليون طن من القمح سنوياً على مساحة 48 مليون هكتار، بمتوسط إنتاجية يبلغ 2.5 طن لكل هكتار، وهو أقل من المتوسط العالمي الذي يبلغ 3 أطنان لكل هكتار. وعلى الرغم من هذا الإنتاج الكبير، تظل المنطقة معتمدة بشكل كبير على الواردات، حيث بلغت واردات القمح 98 مليون طن في عام 2022، بينما كانت الصادرات محدودة بـ 20 مليون طن فقط. ويتفاقم هذا الاختلال بفعل التأثيرات السلبية لتغير المناخ، مثل ارتفاع درجات الحرارة وتذبذب هطول الأمطار، مما يبرز الحاجة الملحة لتحديد وإدخال أصناف القمح الأكثر ملاءمة للمنطقة.

وبناءً على ذلك، فإن تبادل المواد الوراثية بعد أمراً حيوياً لتطوير أصناف جديدة مقاومة للتحديات التي يفرضها تغير المناخ. استجابة لهذه الحاجة، تبذل المنظمة الإسلامية للأمن الغذائي (IOFS) جهوداً في إطار برنامج السلع الاستراتيجية لمنظمة التعاون الإسلامي لتطوير القمح، من

PROMOTING SUSTAINABLE AGRICULTURE IN CENTRAL ASIA THROUGH BIOCHAR APPLICATION



MR. BAKYTZHAN ARYSTANBEK

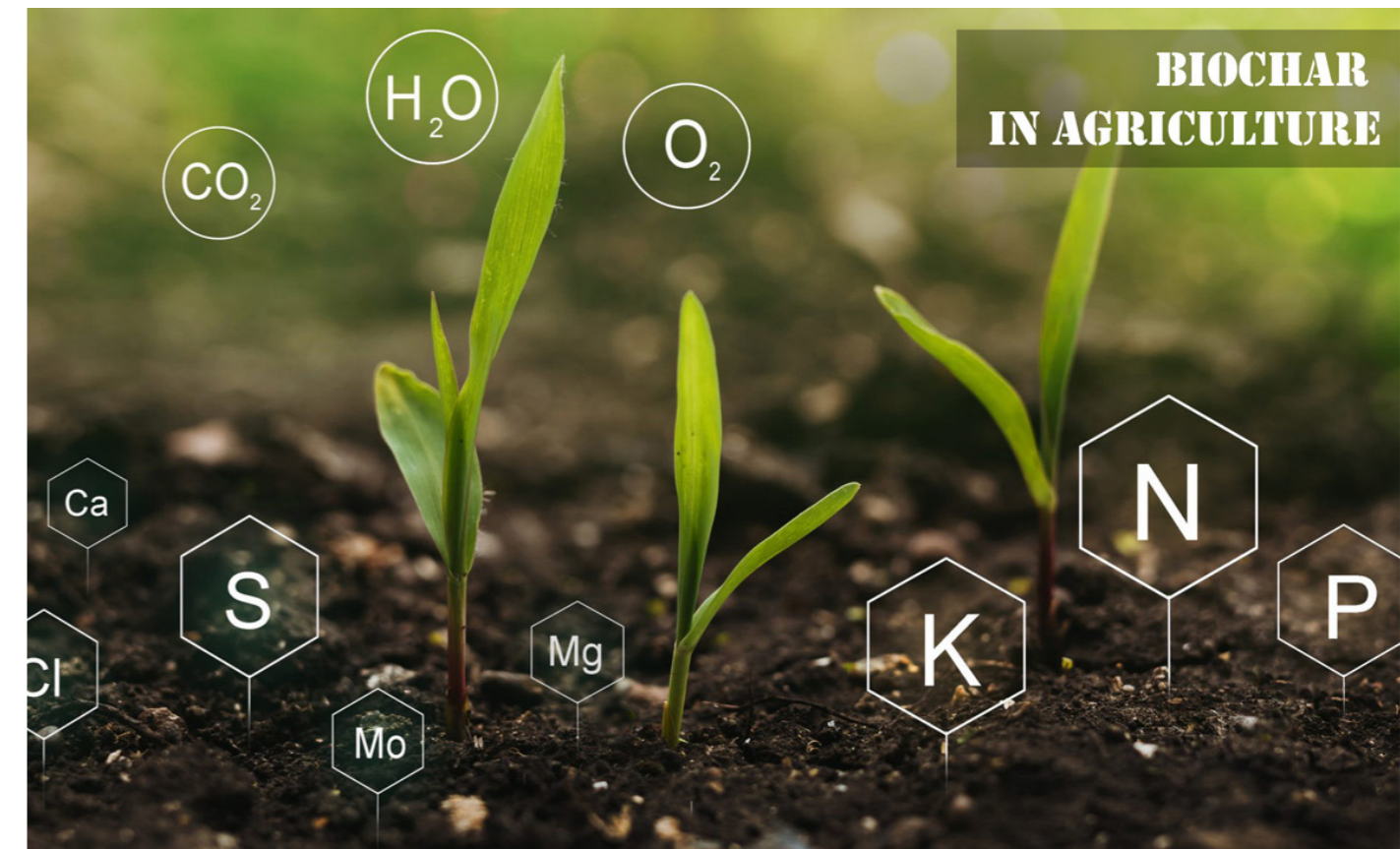
Manager of Programs and Projects Department
Islamic Organization for Food Security

Introduction

The agricultural sector faces significant challenges, particularly in regions like Central Asia, where soil degradation, water scarcity, and extreme weather conditions threaten sustainable crop production. In these areas, effective soil management and resource conservation are critical. Biochar, a charcoal-like substance produced through the pyrolysis of organic matter in a limited oxygen environment, has gained attention as a potential solution to these challenges. Studies show biochar improves soil health by enhancing water retention, nutrient availability, and providing a habitat for beneficial soil microorganisms (Lehmann

& Joseph, 2009). Additionally, biochar's capacity for carbon sequestration contributes to climate change mitigation, making it a valuable tool for sustainable agriculture (Woolf et al., 2010).

Despite its advantages, the adoption of biochar in Central Asia is still in its early stages, requiring greater awareness and technical expertise for widespread implementation. In this context, the Islamic Organization for Food Security (IOFS) has partnered with the Islamic World Educational, Scientific, and Cultural Organization (ICESCO) and local research institutes to introduce biochar technology to the region. This article outlines the scientific basis for biochar's benefits and the initiatives undertaken to promote its use.





The Science of Biochar: Soil Improvement and Climate Resilience

Biochar is known for its beneficial effects on soil physical, chemical, and biological properties. Its porous structure allows for better water retention, especially in arid and semi-arid regions, which are typical of Central Asia. Studies have shown that biochar enhances nutrient availability by retaining essential elements such as nitrogen and phosphorus and releasing them slowly, thus improving plant growth (Bashir et al., 2017). Additionally, biochar serves as a habitat for beneficial microorganisms, which help improve soil health by enhancing nutrient cycling and organic matter decomposition (Lehmann & Joseph, 2009).

A study conducted in Pakistan demonstrated the positive impact of biochar on crop yield in arid conditions, where it was observed that adding biochar to soil resulted in an increase in crop productivity by up to 25% (Bashir et al., 2017). These findings are particularly relevant for Central Asia, where soil degradation and water stress are common.

Moreover, biochar's role in carbon sequestration is a key factor in addressing climate change. By stabilizing organic carbon in the soil, biochar can prevent the release of greenhouse gases like CO₂. This has been demonstrated in long-term studies, where soils amended with biochar showed reduced CO₂ emissions compared to untreated soils (Woolf et al., 2010). Therefore, biochar not only improves soil health but also contributes to global efforts to mitigate climate change.

Biochar in Water Management: An Emerging Solution for Central Asia

In addition to improving soil fertility, biochar has demonstrated potential in water management, especially in regions facing water scarcity. The ability of biochar to retain water makes it a useful tool in improving the water-holding capacity of soils. Research has shown that soils amended with biochar can retain up to 50% more water compared to unamended soils (Haider et al., 2015). This is particularly important in regions like Central Asia, where dry conditions and irregular rainfall patterns can limit crop production.

Furthermore, biochar has been found to improve irrigation efficiency. By increasing the water retention capacity of the soil, it can reduce the amount of water needed for irrigation, which is crucial in areas where water resources are limited. In Qatar, for instance, biochar was applied to sandy soils, resulting in a 30% reduction in water use for crop irrigation (Alherbawi & Al-Haddad, 2022).

Biochar can also assist in filtering and purifying water in polluted soils. A study in Saudi Arabia demonstrated that biochar produced from agricultural waste could adsorb heavy metals and reduce soil contamination, thereby improving both soil and water quality (Al-Wabel et al., 2013). This ability to mitigate soil and water pollution further enhances biochar's potential as a sustainable agricultural input.

Case Study: Biochar in Salinity Management

Soil salinity is another pressing issue in Central Asia, where excessive salt accumulation in the soil can reduce crop yields. Bi-

ochar has shown promise in mitigating the negative effects of salinity on soil health. A study by Haider et al. (2015) found that the application of biochar to saline desert soils significantly improved plant growth and soil microbial biomass. By enhancing the soil's capacity to retain nutrients and water, biochar reduces the stress that salinity places on plants.

In Central Asia, where salinity problems are prevalent in many agricultural areas, biochar can offer a sustainable solution for rehabilitating degraded soils. The Islamic Organization for Food Security (IOFS) has recognized this potential and has worked with experts to explore biochar's role in addressing soil salinity challenges in Kazakhstan, Uzbekistan, and other neighboring countries.

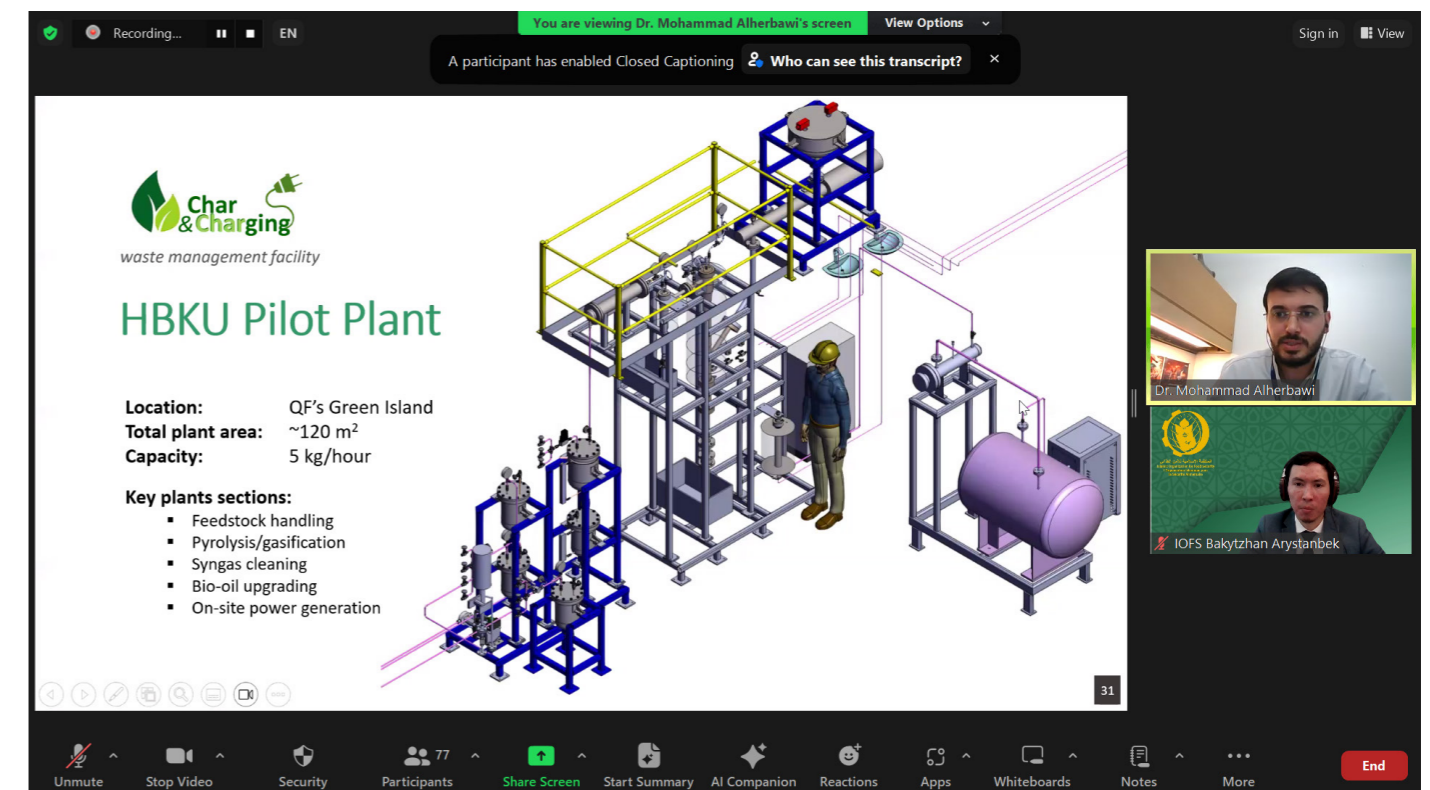
IOFS Initiatives: Biochar for Sustainable Agriculture in Central Asia

Recognizing biochar's potential to address soil degradation and water scarcity, the IOFS has made biochar a focal point of its

strategy to promote sustainable agriculture in Central Asia. In 2024, IOFS, in collaboration with ICESCO, launched a series of initiatives aimed at raising awareness and building capacity for biochar production and application in the region.

The first key initiative was a webinar titled "Utilizing the Potential of Biochar for Soil Improvement and Sustainable Farming," held in July 2024. The event featured presentations from experts, including Dr. Ghulam Haider from the National University of Sciences and Technology (NUST), Pakistan, who shared experiences from biochar projects in Pakistan and Germany (Haider et al., 2015). Dr. Mohammad Alherbawi from Hamad Bin Khalifa University (HBKU), Qatar, also discussed biochar's role in improving water and soil management in Qatar (Alherbawi & Al-Haddad, 2022). The webinar attracted over 82 participants from 19 member states of the Organization of Islamic Cooperation (OIC), highlighting the growing interest in biochar technology.

Following the success of the webinar, IOFS and ICESCO formalized a partnership with the Kazakh National Agrarian Research



University (KazNARU) to implement a project titled "Train Stakeholders on the Use of Biotechnology for Sustainable Farming: Harnessing the Potential of Biochar." This project, which began in August 2024, aims to promote the adoption of biochar technology across Central Asia. The project is divided into two stages:

- **Stage I: Training:** On August 28-29, 2024, a training session was held in Almaty, Kazakhstan, at KazNARU. The training provided participants with hands-on experience in biochar production and application. Participants also gained insights into the science behind biochar and its potential benefits for sustainable farming.

- **Stage II: Research and Implementation:** The second stage involves the deployment of a biochar machine prototype provided by IOFS and ICESCO. The prototype will be used for applied

research at KazNARU and the Kazakh National Research Institute of Soil and Agrochemistry. The results of this research will be shared with the agricultural community in Kazakhstan and the broader Central Asian region in 2025.

The project officially launched on August 28, 2024, with an opening ceremony featuring remarks from key stakeholders, including Prof. Zulfikar Ali, Director of the Programs and Projects Department at IOFS, and representatives from KazNARU and the National Commission of Kazakhstan for UNESCO and ICESCO. On August 29, 2024, participants engaged in hands-on training at the Kazakh Research Institute of Agriculture and Plant Growing, where they gained practical experience in biochar production and its application to enhance soil health and agricultural productivity.

This initiative, which engaged 62 beneficiaries from Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan, marks a significant step



forward in promoting the adoption of biochar technology in Central Asia. The official handover of the biochar machine prototype to KazNARU and the Kazakh National Research Institute of Soil and Agrochemistry further strengthens the region's capacity for applied research on biochar production and application during the autumn of 2024 and spring of 2025. The results of this research will be presented in August 2025.

Conclusion

Biochar has the potential to transform agriculture in Central Asia by addressing the region's pressing challenges of soil degradation, water scarcity, and climate resilience. Through collaboration with ICESCO, KazNARU, and biochar experts from OIC member states, IOFS has taken important steps to introduce and promote the use of biochar. Early results from biochar application projects in Kazakhstan and other Central Asian countries have been promising, showing improvements in soil health, water retention, and crop productivity. Looking ahead, IOFS is committed to scaling up biochar initiatives and contributing to sustainable agricultural development and food security within member states.



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EN SUMMARY

This article explores the potential of biochar technology as a sustainable solution to address agricultural challenges in Central Asia, such as soil degradation and water scarcity. Produced through the pyrolysis of organic matter, biochar improves soil properties, enhances water retention, and supports nutrient cycling. While large-scale adoption in the region is still in its early

stages, the Islamic Organization for Food Security (IOFS), in collaboration with the Islamic World Educational, Scientific, and Cultural Organization (ICESCO), has initiated training and research efforts to introduce biochar. The results of these initiatives, expected in 2025, will help assess biochar's role in improving soil health and promoting sustainable agriculture in the region.

FR RÉSUMÉ

Cet article examine le potentiel de la technologie du biochar comme solution durable pour relever les défis agricoles en Asie centrale, tels que la dégradation des sols et la pénurie d'eau. Produit par pyrolyse de matière organique, le biochar améliore les propriétés des sols, augmente la rétention d'eau et soutient le cycle des nutriments. Bien que l'adoption à grande échelle dans la région en soit encore à ses débuts, l'Organisation Islamique pour

la Sécurité Alimentaire (l'IOFS), en collaboration avec l'Organisation du Monde Islamique pour l'Éducation, la Science et la Culture (ICESCO), a lancé des efforts de formation et de recherche pour introduire le biochar. Les résultats de ces initiatives, attendus en 2025, permettront d'évaluer le rôle du biochar dans l'amélioration de la santé des sols et la promotion de l'agriculture durable dans la région.

ملخص AR

لا يزال في مراحله الأولى، فإن المنظمة الإسلامية للأمن الغذائي (IOFS)، بالتعاون مع المنظمة الإسلامية للتربية والعلوم والثقافة (إيسيسكو)، قد بدأت جهودًا تدريبية وبحثية لإدخال "البيوتشار". من المتوقع أن تساعد نتائج هذه المبادرات، المنتظرة في عام 2025، في تقييم دور "البيوتشار" في تحسين صحة التربة وتعزيز الزراعة المستدامة في المنطقة.

تستكشف هذه المقالة إمكانيات تكنولوجيا "البيوتشار" كحل مستدام لمواجهة التحديات الزراعية في آسيا الوسطى، مثل تدهور التربة وندرة المياه. يتم إنتاج "البيوتشار" من خلال التحلل الحراري للمادة العضوية، ويعمل على تحسين خصائص التربة، وتعزيز احتباس المياه، ودعم دورة المغذيات. ورغم أن اعتماد هذه التكنولوجيا على نطاق واسع في المنطقة



INTEGRATING MODERN TECHNOLOGIES WITH KHATTARAT SYSTEM FOR WATER MANAGEMENT IN THE ARAB WORLD



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Introduction

Water management has always been a challenge in the arid and semi-arid regions of the Arab world, where rainfall is scarce and rivers are few. This challenge has only intensified in recent years, as the effects of climate change, population growth, and increased demand for water resources continue to strain existing water systems. The Arab region is now home to some of the most water-scarce countries in the world.

Traditional water management systems, such as the Khattarat irrigation system, have been instrumental in helping local populations manage their limited water resources for centuries. This system, which originated in the arid regions of the Arab region, has allowed communities to survive in otherwise inhospitable environments by capturing and distributing groundwater through a network of underground channels. However, with growing water demand and changing climate conditions, the Khattarat system, while ingenious, is no longer sufficient to meet the needs of modern agriculture.

The Khattarat, also known as “Khattara” or “qanat” in other regions, is an ancient irrigation technique that dates back over a thousand years. It originated in regions of Persia and spread across North Africa, specifically in Morocco, where it became a vital part of the agricultural landscape, particularly in the Atlas Mountains and surrounding areas. The system relies on gravity to transport groundwater from higher elevations to the surface through a series of underground tunnels.

In the Arab region, the Khattarat system has been instrumental in supporting the agriculture of oasis regions. These tunnels are dug by hand, often stretching for kilometers, to tap into underground water sources that are otherwise inaccessible. The system’s design minimizes evaporation by keeping the water underground until it reaches the surface, making it highly efficient for arid climates where surface water quickly evaporates under the sun’s heat.

The Khattarat system is not only a technical marvel but also a social structure. The construction and maintenance of Khattarat systems require collective labor and cooperation from the entire community. Historically, the water collected and distributed by the Khattarat system was shared equitably among farmers and households in a village, ensuring that everyone had access to water, no matter how scarce it was. Water is sourced from

a mother well that taps into underground aquifers and flows through gently sloping underground qanat channels, using gravity to maintain a steady flow. Access shafts enable maintenance, while the water exits through an outlet and is distributed through a network of channels to irrigate fields. By keeping the water underground, the system minimizes evaporation, making it highly efficient in water-scarce environments. Positioned at or just below the water table, it ensures effective groundwater use for agriculture (Figure 1).

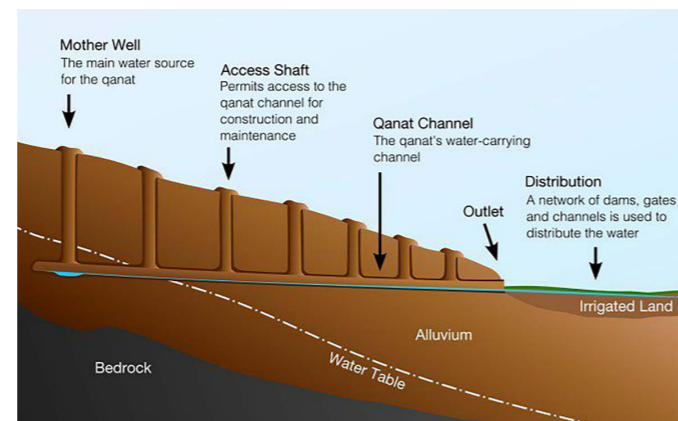


Figure 1: Structure and Function of the Khattarat Irrigation System

However, while the system is highly effective in preserving water, it also faces several challenges. Over time, many Khattarat systems have fallen into disrepair due to the high labor costs associated with maintaining them, as well as the declining availability of groundwater. As groundwater levels have dropped due to over-extraction and climate change, many Khattarat systems are no longer able to provide the water they once did. The underground tunnels have been abandoned in some areas, leaving communities vulnerable to drought.

The Case for Modernizing Khattarat Systems

Modernizing this system is essential to improve water management, boost productivity, and minimize negative effects like salinization. Traditional methods alone are no longer sufficient in managing water resources effectively. Therefore, upgrading Khattarat through rehabilitation and the introduction of mod-

ern technologies such as sensors, automated controls, and solar-powered pumps is necessary. These advancements allow for real-time monitoring of water use and more efficient irrigation, addressing the growing need for cost-effective and sustainable water systems in regions with scarce water supplies.

One of the most significant benefits of modernization is the potential for increased water productivity, as modern systems enable the irrigation of larger areas with the same or even less water. The flexibility that comes with modernized water delivery systems allows farmers to adapt more quickly to crop needs, improving yields and optimizing water use, integrating renewable energy solutions, like solar-powered irrigation pumps, the Khattarat system can also reduce its environmental impact, contributing to sustainability in agriculture. Moreover, modernization encourages better reliability in water supply, enabling farmers to plan their crop cycles more accurately and make better use of other agricultural inputs.

However, modernization is not without its challenges. Financial constraints, technical expertise, and social barriers such as collective water management present obstacles, particularly for small-scale farmers. To ensure successful modernization, governments and institutions must provide financial support and capacity-building initiatives to train farmers and irrigation managers on the use of new technologies. Despite these hurdles, the modernization of Khattarat systems is essential for ensuring sustainable water management in the Arab world, combining traditional practices with modern innovations to meet the growing demands of agriculture in a changing climate.

The Role of Modern Technologies in Water Management

1. Sensors and Automation in Irrigation Systems

The development and deployment of sensors in agriculture have revolutionized the way farmers manage their water resources. Sensors can be embedded in the soil to measure moisture levels, giving farmers real-time data on the water needs of their crops. This data allows for more precise irrigation, ensuring that crops receive the exact amount of water they need, when they need it.

In the context of the Khattarat system, sensors can be deployed along the tunnels to monitor the water levels and flow rates, providing valuable information on the system’s efficiency. When combined with automated control systems, these sensors can regulate the flow of water through the system, reducing the risk of over-irrigation and water wastage.

Automated systems can also be used to manage water distribution based on the specific needs of different crops. For example, sensors can detect when a field requires more water and automatically adjust the flow of water from the Khattarat system to meet the demand. This technology can help farmers make more informed decisions about water use, leading to higher crop yields and better resource management.

2. IoT-Controlled Irrigation Systems

The Internet of Things (IoT) has introduced a new era of connected devices, allowing farmers to monitor and manage their irrigation systems from anywhere in the world. IoT-enabled irrigation systems can be controlled remotely, giving farmers the ability to adjust their water use based on real-time data from sensors and weather forecasts.

In regions where the Khattarat system is still in use, IoT technology can be integrated to automate the opening and closing of

water gates and channels, optimizing the flow of water through the system. This reduces the need for manual labor and allows farmers to respond quickly to changes in water availability or crop needs.

Furthermore, IoT-enabled systems can send alerts to farmers when water levels in the Khattarat system are running low, helping to prevent water shortages and allowing for better long-term planning. This level of control and oversight is particularly valuable in regions where water resources are scarce and the cost of water is high.

3. Renewable Energy and Sustainable Water Management

Solar power and other forms of renewable energy offer a sustainable solution to the challenges of water management in the Arab world. By integrating solar-powered pumps into the Khattarat system, farmers can ensure a steady supply of water even during periods of drought or low groundwater levels.

In many regions, the cost of running diesel-powered pumps can be prohibitively expensive, leading to over-extraction of groundwater and further depletion of water resources. Solar-powered pumps, on the other hand, offer a more affordable and environmentally friendly alternative, allowing farmers to irrigate their crops without contributing to the carbon emissions that drive climate change.

When combined with modern irrigation technologies, renewable energy can help farmers reduce their reliance on fossil fuels and lower their overall environmental impact. This makes it easier for communities to adopt sustainable practices that not only conserve water but also protect the environment for future generations.

In addition to the Khattarat system, farmers have developed several other water management techniques to adapt to the impacts of climate change on their agricultural activities. In the eastern region, where water scarcity is a recurring issue, farmers have devised simple yet effective water storage techniques. These include small ponds that collect runoff from slopes, as well as cisterns for drinking water, which use the roofs of houses as catchment areas. In some cases, communal cisterns are built to collect water from specially designed tracks or surfaces that act as catchment areas.

Farmers in this region have also developed water collection basins that gather water from scattered springs in the mountains. These traditional techniques, while basic, have allowed communities to manage water more effectively in times of shortage. The integration of traditional practices with cutting-edge solutions represents a holistic approach to managing scarce water resources in arid regions like the Arab world.

Arab region Oases and Khattarat System Modernization

Arab region has long relied on the Khattarat system to irrigate its arid and semi-arid regions, particularly in the southern oases. These oases are home to small-scale farmers who depend on groundwater for their crops, primarily date palms, cereals, and vegetables. In recent years, the government modernize the Khattarat system to address the growing challenges of water scarcity and climate change.

Several pilot projects have been launched to integrate modern technologies into the traditional Khattarat system. One such

project in the Tafilalet oasis region has successfully introduced soil moisture sensors, automated irrigation systems, and solar-powered pumps to enhance water efficiency and reduce labor costs. These technologies have allowed farmers to monitor their water use more precisely and adjust their irrigation practices based on real-time data.

The introduction of renewable energy technologies, particularly solar panels, has also helped reduce the reliance on diesel-powered pumps. Solar energy is abundant in the region, making it a practical and sustainable solution for powering irrigation systems. Farmers can now irrigate their crops without the high costs associated with diesel fuel, and the use of solar-powered pumps has reduced the environmental impact of water extraction (Figure 2).



Figure 2: Comparison of Traditional Canal Irrigation vs. Modern Irrigation Methods. Photos: Rachel Santarsiero

Smart Irrigation Strategies for the Arab Region

In recent years, countries across the Arab region have made significant strides in advancing water management technologies, particularly in the adoption of water-saving irrigation techniques. With growing concerns over water scarcity and climate change, the Arab region has increasingly focused on expanding the use of efficient irrigation systems to improve agricultural resilience. The region's governments, through strong institutional frameworks, have taken the lead in managing and promoting irrigation infrastructure development.

One of the key strategies has been the large-scale implementation of drip irrigation systems, supported by public-private partnerships (PPPs). These partnerships have been instrumental in fostering innovation and ensuring the widespread adoption of modern irrigation technologies. Many countries in the region have implemented programs similar to Morocco's Plan Maroc Vert, The Green Generation Plan and the National Program for Irrigation Water Saving (PNEEI), which offer subsidies to farmers and agricultural cooperatives to modernize their irrigation practices.

As a result, the area covered by drip irrigation systems in the Arab region has expanded significantly, making agriculture more resilient to climatic shocks, such as droughts, which are becoming more frequent due to climate change. The adoption of smart irrigation strategies has minimized the impact of these shocks on agricultural productivity, ensuring food security even in difficult conditions. These advancements exemplify how combining modern technology with strong institutional support and public-private collaboration can improve water management, increase agricultural productivity, and enhance resilience across the Arab region.

Challenges in Implementing Modern Technologies

While the integration of modern technologies into traditional irrigation systems like the Khattarat offers many benefits, it also presents several challenges. One of the primary obstacles is the high cost of technology, which can be prohibitive for small-scale farmers in rural areas. The installation of sensors, automated systems, and solar-powered pumps requires significant investment, which may be beyond the reach of many farmers who rely on the Khattarat system for their livelihoods.

Additionally, the successful implementation of these technologies requires technical expertise and training. Farmers must be able to operate and maintain the systems effectively, which may require ongoing support from agricultural extension services and government agencies. Without adequate training and support, there is a risk that the technologies will not be used to their full potential or may fall into disrepair over time.

Challenges and Opportunities

Despite the clear benefits, there are several obstacles to modernizing Khattarat systems. Financial constraints remain a significant barrier, particularly for smallholder farmers. Furthermore, the adoption of new technologies can be slowed by technical gaps, lack of expertise, and institutional inertia.

However, the opportunities presented by modernization far outweigh these challenges. Through targeted investments in technology, training, and infrastructure, the Arab region can develop irrigation systems that are both efficient and sustainable. With a combination of traditional knowledge and cutting-edge innovations, the Khattarat system can continue to play a vital role in the region's agricultural future.

EN SUMMARY

The integration of modern technologies with the ancient Khattarat irrigation system offers a promising solution to the water management challenges faced by the Arab world. As water scarcity and climate change intensify, traditional methods are increasingly insufficient. Innovations such as sensors, automation,

IoT-controlled irrigation systems, and renewable energy sources are improving the efficiency and sustainability of the Khattarat system. This modernization, driven by public-private partnerships and government programs, is essential for enhancing agricultural resilience in the region.

FR RÉSUMÉ

L'intégration des technologies modernes au système d'irrigation traditionnel des Khattarat constitue une solution prometteuse aux défis de la gestion de l'eau auxquels fait face le monde arabe. Avec l'aggravation de la rareté de l'eau et du changement climatique, les méthodes traditionnelles deviennent insuffisantes. Les innovations telles que les capteurs, l'automatisation, les sys-

tèmes d'irrigation contrôlés par l'Internet des objets et les sources d'énergie renouvelable améliorent l'efficacité et la durabilité du système Khattarat. Cette modernisation, portée par des partenariats public-privé et des programmes gouvernementaux, est essentielle pour renforcer la résilience agricole dans la région.

ملخص AR

الخَطَّارات. هذا التحديث، الذي تقوده الشراكات بين القطاعين العام والخاص والبرامج الحكومية، ضروري لتعزيز مرونة الزراعة في المنطقة. من خلال الجمع بين الممارسات التقليدية والتطورات الحديثة، يمكن للعالم العربي تحسين استخدام المياه، وزيادة الإنتاجية الزراعية، وضمان استدامة أكبر في مواجهة الضغوط البيئية.

يعد دمج التقنيات الحديثة مع نظام الري التقليدي «الخَطَّارات» حلاً واعدًا لتحديات إدارة المياه التي تواجه العالم العربي. مع تزايد ندرة المياه وتغير المناخ، أصبحت الأساليب التقليدية غير كافية. تساهم الابتكارات مثل أجهزة الاستشعار، الأنظمة الآلية، أنظمة الري المعتمدة على إنترنت الأشياء، ومصادر الطاقة المتجددة في تحسين كفاءة واستدامة نظام



REGULATORY FRAMEWORKS AND POLICY COHERENCE IN WATER GOVERNANCE: INSIGHTS FROM OIC COUNTRIES



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Introduction

Water governance is a critical issue in many **Organization of Islamic Cooperation (OIC)** countries, where water scarcity, population growth, and climate change intensify the challenges of managing this vital resource. Water scarcity impacts over 40% of the world's population, as reported by the World Bank. Additionally, water-related disasters are responsible for 70% of all fatalities resulting from natural disasters.¹

Effective governance depends not only on the availability of water but also on the strength and coherence of regulatory frameworks that govern its use. **A robust governance framework** ensures that water is managed sustainably and equitably, balancing the needs of agriculture, industry, and domestic use while protecting ecosystems. This is where the OECD's water governance policy cycle becomes particularly relevant. The OECD framework outlines a cyclical process of designing, implementing, monitoring, and evaluating water policies, which is essential for adapting to the dynamic challenges OIC countries face. By following this cycle, OIC nations can ensure that their water governance systems are resilient and responsive to the pressures of scarcity, population growth, and climate change.²

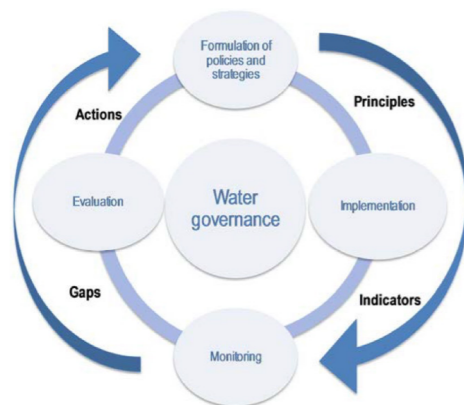


Figure 1. The water governance cycle.
Source: OECD Studies on Water, OECD (2018)

This article explores the role of **regulatory frameworks** in water governance across OIC countries, with a focus on the importance of **policy coherence** and the lessons that can be drawn from successful case studies.

The Importance of Regulatory Frameworks in Water Governance

Regulatory frameworks provide the legal and institutional basis for managing water resources. In OIC countries, where water resources are often scarce and unevenly distributed, these frameworks are crucial for ensuring that water is used efficiently and equitably. **Effective regulatory frameworks** help balance the competing demands of agriculture, industry, and domestic use, while also protecting ecosystems and ensuring long-term sustainability.

In terms of **sectoral demand**, agriculture accounts for the vast majority of water demand both globally and in the OIC. In the OIC, water withdrawal for the agricultural sector accounts for 87% of total water withdrawal, compared to industrial and municipal demands that account for 4% and 9%, respectively. This highlights the intimate link between water management and food security in the region. As the demand for food increases, so too does the demand for water, making effective regulatory frameworks even more essential to mitigate the risks of water scarcity on food security.³

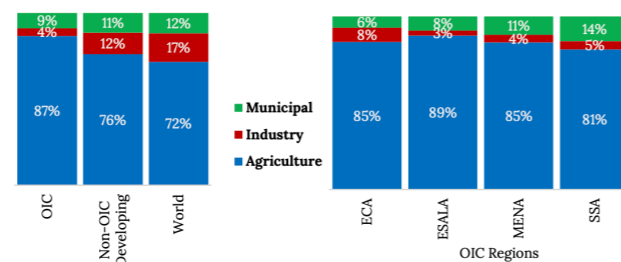


Figure 2. Water Demand by Sector
Source: OIC Water Report 2021, SESRIC (2021)

However, the effectiveness of these frameworks can be significantly compromised by the fragmentation of water governance in many OIC countries. Different agencies and levels of government often have overlapping responsibilities, leading to conflicting policies and inefficiencies. This fragmentation is particularly challenging in the context of competing water demands between sectors, especially agriculture, which plays a vital role in the economy of OIC countries. With water demand expected to grow significantly in the coming decades, particularly in agriculture, it is crucial that regulatory frameworks not only manage current water resources but also anticipate future demands, ensuring sustainable water allocation across all sectors.

Policy Coherence: A Key to Effective Water Governance

Policy coherence, which involves aligning and integrating policies across sectors and levels of government, is essential for effective water governance. This means ensuring that policies related to water use, environmental protection, agriculture, and urban development are consistent and mutually reinforcing. The need for policy coherence is particularly critical in OIC countries, where fragmented governance structures often lead to overlapping responsibilities, conflicting policies, and inefficiencies that hinder effective water management.

The OECD Principles on Water Governance emphasize the importance of cross-sectoral coordination to achieve policy coherence. According to Principle 3, effective water governance requires mechanisms that facilitate coherent policies across ministries, public agencies, and levels of government. This includes the development of cross-sectoral plans that integrate water management with related areas such as environment, health, energy, agriculture, industry, spatial planning, and land use.⁴

In OIC countries, achieving policy coherence is often challenging due to the complexity and fragmentation of water governance. For example, while water policies may be developed at the national level, their implementation is often left to regional or local authorities, resulting in discrepancies between policy objectives and on-the-ground practices. This fragmentation can lead to unintended consequences, such as groundwater over-extraction or water pollution, particularly when policies related to agriculture, industry, and urban development fail to consider their impacts on water resources.

To address these challenges, it is crucial to encourage coordination mechanisms that align policies across different sectors and levels of government. This includes fostering coordinated management of water resources, which takes into account the diverse policies that affect water availability, quality, and demand. For instance, the integration of policies from sectors like agriculture, forestry, mining, energy, and transportation can help ensure that water management needs are met while mitigating conflicts among sectoral strategies.

Moreover, identifying and addressing barriers to policy coherence—whether they stem from practices, policies, or regulations—can be achieved through robust monitoring, reporting, and review processes. By providing incentives and establishing regulations that align sectoral strategies with water management needs, OIC countries can develop solutions that are both effective and compatible with local governance and norms. These measures not only support sustainable water management but also contribute to broader goals of environmental protection, economic development, and social well-being.

Insights from OIC Countries: Successful Regulatory Frameworks and Policy Coherence

Several OIC countries have made significant progress in strengthening their regulatory frameworks and improving policy coherence in water governance. The following examples highlight some of the key lessons that can be drawn from their experiences:

- **Morocco: Integrated Water Resources Management (IWRM)**

Lesson: Morocco has implemented a comprehensive Integrated Water Resources Management (IWRM) approach that ensures the coherent management of water resources across sectors. The country's Water Law 10-95 provides a legal framework for the sustainable management of water resources, with clear roles and responsibilities assigned to different agencies. The law also promotes public participation and the integration of water management with environmental protection, agriculture, and urban planning.⁵

Key Takeaway: A clear legal framework that integrates water management with other policy areas can enhance policy coherence and improve the effectiveness of water governance.

- **Türkiye: Harmonization of Water Policies**

Lesson: Türkiye has made significant strides in harmonizing its water policies with EU regulations as part of its accession process. This has involved aligning national policies with international standards, improving coordination between different levels of government, and ensuring that water policies are consistent with broader environmental and agricultural policies.⁶

Key Takeaway: Aligning national policies with international standards and improving coordination between different levels of government can enhance policy coherence and support more effective water governance.

- **Jordan: Decentralization and Stakeholder Engagement**

Lesson: Jordan has adopted a decentralized approach to water governance, with significant involvement of local stakeholders in decision-making processes. This approach has helped to ensure that water policies are tailored to local conditions and that there is greater coherence between national policies and local practices.⁷

4 OECD (2015), OECD Principles on Water Governance, https://www.oecd.org/content/dam/oecd/en/topics/policy-sub-issues/water-governance/oecd-principles-on-water-governance-en.pdf/_jcr_content/renditions/original/oecd-principles-on-water-governance-en.pdf.

5 Loudyi, Dalila; Oubalkace, Mohamed (2015), Water governance in Morocco, International Association for Hydro-Environment Engineering and Research (IAHR). S. 122-125. https://iahr.oss-accelerate.aliyuncs.com/library/HydroLink/HydroLink2015_04_Africa.pdf.

6 Kibaroglu, Aysegül & Baskan, Argun (2011), Turkey's Water Policy Framework. 10.1007/978-3-642-19636-2_1. https://www.researchgate.net/publication/301184614_Turkey%27s_Water_Policy_Framework

7 Ministry of Water and Irrigation of the Hashemite Kingdom of Jordan (2016), Decentralized Wastewater Management Policy. https://mwi.gov.jo/ebv4.0/root_storage/ar/eb_list_page/decentralized_wastewater_management_policy-1.pdf

1 World Bank (2024), Water Resources Management. <https://www.worldbank.org/en/topic/waterresourcesmanagement>

2 OECD (2018), Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices, OECD Studies on Water, <https://doi.org/10.1787/9789264292659-en>

3 SESRIC (2021), OIC Water Report 2021, <https://sesricdiag.blob.core.windows.net/sesric-site-blob/files/article/778.pdf>

Key Takeaway: Decentralization and stakeholder engagement can enhance policy coherence by ensuring that policies are responsive to local needs and conditions.

Challenges to Achieving Policy Coherence in OIC Countries

Despite these successes, achieving policy coherence in water governance remains a significant challenge in many OIC countries. Some of the key barriers include:

- **Fragmentation of responsibilities:** In many countries, responsibilities for water management are spread across multiple agencies and levels of government, leading to overlapping mandates and conflicting policies.⁸
- **Lack of data and information sharing:** Achieving effective policy coherence in water governance requires accurate and timely data on water resources. However, many OIC countries face significant challenges in establishing robust data collection systems and mechanisms for sharing information (SESRIC, 2021).
- **Political and institutional barriers:** Efforts to achieve policy coherence in water governance are often obstructed by political instability, weak institutional frameworks, and a lack of political will. These challenges can significantly impede the development and implementation of coherent water policies, as unstable political environments and under-resourced institutions struggle to coordinate across sectors and levels of government (SESRIC, 2021).

Recommendations for Strengthening Policy Coherence in Water Governance

To strengthen policy coherence in water governance, OIC countries should consider the following recommendations:

1. **Develop Comprehensive National Water Strategies:** National water strategies should provide a clear and coherent framework for managing water resources, integrating policies across sectors and levels of government.
2. **Enhance Interagency Coordination:** Mechanisms should be established to improve coordination between different agencies and levels of government, ensuring that policies are aligned and mutually reinforcing.
3. **Promote Stakeholder Engagement:** Involving stakeholders, including local communities, in the development and implementation of water policies can help to ensure that policies are coherent and responsive to local needs.
4. **Invest in Data Collection and Information Sharing:** Improved data collection and information sharing mechanisms are essential for supporting coherent policymaking and effective water governance. It is crucial for policymakers to focus on setting up standardized frameworks for data collection, along with key indicators and targets to track progress. This will enable better prediction and response to emerging risks and facilitate the development of inclusive policies. The OIC Water Vision, which provides guidance on water management up to 2025, underscores the importance of these efforts. Moving forward, OIC countries could benefit from preparing a strategic plan, such as a 'Water Action Plan,' that includes detailed guidelines on data collection, monitoring, and reporting mechanisms, aligning with the Sustainable Development Goals (SDGs) to ensure measurable progress and shared knowledge across the region (SESRIC, 2021).
5. **Align National Policies with International Standards:** OIC countries should seek to align their national water policies with international standards and best practices, ensuring consistency and coherence across policy areas.

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EN SUMMARY

Water governance is a critical concern for countries within the Organization of Islamic Cooperation (OIC), especially as they face the mounting challenges of water scarcity, rapid population growth, and the escalating impacts of climate change. These complexities underscore the urgent need for strong regulatory frameworks and coherent policies that ensure the sustainable and equitable management of water resources across various sectors.

This article explores the essential role that regulatory frameworks play in water governance, with a particular emphasis on the importance of policy coherence. It highlights successful case studies from OIC member states like Morocco, Türkiye, and Jordan, which have made significant strides in strengthening their regulatory environments and achieving greater alignment of policies across different sectors and levels of government. How-

ever, many OIC nations continue to encounter challenges, such as fragmented governance structures, gaps in data collection, and political barriers that hinder effective water management.

Building on these insights, the article offers practical recommendations to improve policy coherence within the region. The suggestions include the development of comprehensive national water strategies, enhanced interagency coordination, active stakeholder engagement, investments in data collection and analysis, and alignment of national policies with international standards. By addressing these challenges head-on, OIC countries can develop more resilient and effective water governance systems, ensuring long-term water security and contributing to sustainable development for their populations.

FR RÉSUMÉ

La gouvernance de l'eau est une préoccupation critique pour les pays membres de l'Organisation de la Coopération Islamique (OCI), notamment en raison des défis croissants liés à la pénurie d'eau, à la croissance rapide de la population et aux impacts accrus du changement climatique. Ces complexités soulignent l'urgence de mettre en place des cadres réglementaires solides et des politiques cohérentes pour garantir une gestion durable et équitable des ressources en eau dans divers secteurs. Cet article explore le rôle essentiel des cadres réglementaires dans la gouvernance de l'eau, en mettant particulièrement l'accent sur l'importance de la cohérence des politiques. Il met en lumière des études de cas réussies provenant d'États membres de l'OCI tels que le Maroc, la Turquie et la Jordanie, qui ont réalisé des avancées significatives dans le renforcement de leurs environnements réglementaires et dans l'alignement accru des politiques à travers différents secteurs et niveaux de gouvernement. Cepend-

ant, de nombreux pays de l'OCI continuent de rencontrer des défis tels que des structures de gouvernance fragmentées, des lacunes dans la collecte de données et des barrières politiques qui freinent une gestion efficace de l'eau. En se basant sur ces constats, l'article propose des recommandations pratiques pour améliorer la cohérence des politiques dans la région. Les suggestions incluent le développement de stratégies nationales de l'eau complètes, une meilleure coordination inter-agences, une implication active des parties prenantes, des investissements dans la collecte et l'analyse des données, ainsi que l'alignement des politiques nationales avec les normes internationales. En abordant ces défis de front, les pays de l'OCI peuvent développer des systèmes de gouvernance de l'eau plus résilients et efficaces, assurant ainsi la sécurité de l'eau à long terme et contribuant au développement durable de leurs populations.

ملخص AR

منظمة التعاون الإسلامي تواجه تحديات مثل هياكل الحوكمة المجزأة، وفجوات في جمع البيانات، وعوائق سياسية تعرقل الإدارة الفعالة للمياه.

بناءً على هذه الرؤى، تقدم المقالة توصيات عملية لتحسين تنسيق السياسات داخل المنطقة. وتشمل هذه التوصيات تطوير استراتيجيات وطنية شاملة للمياه، وتعزيز التنسيق بين الوكالات، وإشراك أصحاب المصلحة بشكل فعال، والاستثمار في جمع البيانات وتحليلها، ومواءمة السياسات الوطنية مع المعايير الدولية. من خلال مواجهة هذه التحديات بشكل مباشر، يمكن لدول منظمة التعاون الإسلامي تطوير أنظمة حوكمة مياه أكثر مرونة وفعالية، مما يضمن الأمن المائي على المدى الطويل والمساهمة في التنمية المستدامة لسكانها.

تشكل إدارة المياه قضية حاسمة لدول منظمة التعاون الإسلامي (OIC)، خاصة مع تزايد تحديات ندرة المياه والنمو السكاني السريع وتأثيرات تغير المناخ المتصاعدة. تبرز هذه التعقيدات الحاجة الملحة إلى أطر تنظيمية قوية وسياسات متناسقة تضمن الإدارة المستدامة والعادلة لموارد المياه عبر مختلف القطاعات.

تستعرض هذه المقالة الدور الأساسي الذي تلعبه الأطر التنظيمية في إدارة المياه، مع التركيز بشكل خاص على أهمية تنسيق السياسات. كما تسلط الضوء على دراسات حالة ناجحة من دول أعضاء في منظمة التعاون الإسلامي مثل المغرب وتركيا والأردن، التي حققت خطوات كبيرة في تعزيز بنيتها التنظيمية وتحقيق توافق أكبر في السياسات بين القطاعات والمستويات الحكومية المختلفة. ومع ذلك، لا تزال العديد من دول

8 World Bank (2018), *Water Management in Fragile Systems: Building Resilience to Shocks and Protracted Crises in the Middle East and North Africa*. <https://www.worldbank.org/en/topic/water/publication/water-management-in-fragile-systems>

THE VALUE OF EDILBAY SHEEP



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Sheep were domesticated approximately 10-12 thousand years ago. Along with goats and dogs, they are considered one of the first animals domesticated by humans. The main changes that have occurred after the domestication of sheep through genetic improvements are traits that affected the efficiency of meat, wool, and milk production.

Sheep have 54 chromosomes (27 pairs). The sheep genome map is currently being researched by scientists worldwide. The distribution of genes on the map is used in systematic studies of chromosomes that control economically important traits.

Two types of selection are applied in sheep breeding: natural and artificial. Natural selection or “survival of the fittest” allows sheep better adapted to the environment to survive and produce more offspring. Artificial selection is the human-imposed genetic improvement of economically important traits.

The value of economically important traits can vary significantly among farmers. Farmers who emphasize different traits use different breeds of sheep. Genetic improvement is then carried out through sequential selection for one or more traits within the chosen breed. Plus, crossbreeding is done using systematic mating systems to produce offspring of a specific type. This results in crossbred offspring, which usually surpass any of the existing purebred types. Crossbreeding is more commonly used in commercial sheep farming in the USA, Europe, Russia, and Kazakhstan, where most lambs for slaughter are crossbred.

There are several explanations for crossbred sheep. The choice of breed or breed combination of sheep is used to determine mass, fecundity, breeding season, and adaptation to environmental conditions and market demands. This is an important decision for improving commercial flocks and addressing economic issues.

In 2022, by leadership of Republic Center for Animal Selection and Breeding, Asul-Tulik, a consortium of sheep breeders in the Northern regions of Kazakhstan was established as part of business and science cooperation to produce and export lamb for domestic and foreign markets. The primary goal of the sheep breeders’ cooperation was and remains the creation of a line of gene carriers with high live weight, with clear transmission of meat breed traits (regional adaptability to the Northern and Central regions of Kazakhstan, ewe milk production, polyestrous cycles, high meat quality).

The consortium includes active sheep farms from Ulytau Region: KX “Birlestik,” KX “Suleimenov K,” KX “Sivka Burka,” LLP “Jana Bereke,” LLP “Altyn Kazyk” from Akmola Region, LLP “Shugyla” from North Kazakhstan Region, and LLP “Tava-Agro” from Pavlodar Region. The consortium also includes service companies providing veterinary services: LLP “Kokshe-Zoovetsnab,” LLP “Cowmas Qazaqstan” for digitalization and IT technologies, animal registration, and accounting, JSC “RCPJ ‘Asyl Tulik’” for reproductive services and genetic transformation of sheep. The total sheep population is approximately 40,000 heads of the Kazakh breed.

The idea behind the consortium of farms and service companies was to develop, preserve, and reproduce the genetic resources of local Kazakh breeds of fat-tailed and Edilbay sheep in Northern Kazakhstan. This idea of preserving genetic resources was actively supported by the Astana office of the International Islamic Organization for Food Security.

The consortium’s main goal was for agricultural producers, in collaboration with science, to conduct a unified breeding program for crossbred breeds in farms in the Central and Northern regions of Kazakhstan. This includes further increasing the number of line animals, using inter-line crossings, and obtaining the desired selection of sheep adapted to local climatic conditions in Central and Northern Kazakhstan.

The importance of the model for JSC “Asyl-Tulik” and the sheep breeders’ cooperation is the possibility of applying modern methods of selection and reproduction biotechnology, which can be used for intensive reproduction of high-quality lamb using artificial insemination of Kazakh fat-tailed ewes with frozen semen from specialized meat breed rams of foreign selection in Kazakhstan.

The task of the proposed method is to obtain early maturing meat lambs to create a breeding line and produce competitive lamb. This method will intensify the selection process to obtain early maturing meat lambs (4-5 months, 40-45 kg live weight).

With active participation from science and business, implementing this project enables the development of technology for accelerated reproduction and intensive production of eco-friendly lamb in pasture conditions. The project is socially oriented, helping to create new jobs in industrial feeding and introducing new reproduction technologies to improve lamb

production based on the cooperation of sheep breeders in the Central and Northern regions of Kazakhstan.

There are all the prerequisites for producing premium-class lamb. The high evaluation of the export product by foreign buyers in the Gulf region today provides an opportunity to create a national lamb brand in the global market, which will naturally be sold at a high price as a dietary and eco-friendly product.

The sheep breeders’ consortium has set key priorities for organizing and producing commercial lamb for the domestic market and export. Precision livestock farming is an important and indispensable tool for farmers, breeders, and breeding farms to:

- Implement selection programs focused on productivity and production.
- Sheep farm management.
- Extract, process, and manage animal data flow.
- Create a sheep breed line for producing export-oriented lamb to meet international market needs.
- Digitalize to increase the efficiency of selection programs in sheep farming.
- Develop more sustainable and efficient sheep breeding practices using precision sheep farming systems.
- Support the technological cycle, digitize events in sheep farming (veterinary, zootechnics, reproduction, feeding, housing).
- Address social factors, employment, and entrepreneurship in rural areas. The project is an opportunity to create professional family sheep farms in the Republic of Kazakhstan with an efficient farming system.

Currently, with the shift to prioritizing meat sheep farming and the emergence of dairy sheep farming in our region, the biologically determined seasonality of sheep reproduction has become

a critical point, limiting the industry’s efficiency. This is because the market requires year-round production and supply of meat and dairy products. Therefore, technologies are needed to allow year-round sheep reproduction.

We see the solution to this problem in the following: to maintain the primary meat productivity direction of the Edilbay breed, it is necessary to effectively add the imported genotype of specialized meat breeds like Dorper, Suffolk, Hampshire, and others through introgressive crossbreeding, following recommendations, without losing the high adaptive qualities of the Edilbay sheep breed in the Northern and Central regions of Kazakhstan.

It is planned that with the support of scientific and service organizations, the crossbred sheep obtained will be selected for desirable types to produce export-oriented lamb and will be bred “within the breed.” Using white Dorper, Suffolk, and Hampshire will produce sheep with fine wool, which is in high demand.

Today, by implementing this project, we hope to achieve new breeding lines of Edilbay sheep with high productive and breeding qualities:

- Create a Kazakh reproducer of “Dorperized” sheep for producing export-oriented early maturing lambs;
- Establish a domestic brand of eco-friendly lamb.

The inheritance of economically beneficial traits such as polyestrous cycles, high fertility, and meat productivity with the best technological qualities and marbling will allow for accelerated reproduction and intensive lamb production, resulting in three lambings in two years. Using imported genotypes of meat breeds Dorper, Suffolk, Hampshire also allows for not only marbled meat but also high-quality fine and semi-coarse wool for producing carpets, coarse cloth, and felt products. Additionally, sheepskin will be widely used in the light industry to manufacture sheepskin coats, semi-sheepskin coats, velour, and more.



EN SUMMARY

Sheep, among the first animals domesticated by humans around 10-12 thousand years ago, have undergone significant genetic improvements to enhance meat, wool, and milk production. The ongoing mapping of the sheep genome, which consists of 54 chromosomes, aids in understanding and optimizing economically important traits through both natural and artificial selection. In 2022, the Asyl-Tulik consortium was established in Northern Kazakhstan, uniting sheep breeders and service providers to advance local sheep breeds. The consortium's goal is to produce high-quality lamb for both domestic and international

markets by developing a line of crossbred sheep with desirable traits such as high live weight and regional adaptability. This initiative focuses on modern breeding techniques and reproductive biotechnologies, including artificial insemination with imported semen, to create early maturing lambs. By addressing seasonal reproduction challenges and integrating precision livestock farming, the consortium aims to produce premium, eco-friendly lamb and establish a strong domestic brand, contributing to rural development and enhancing Kazakhstan's position in the global lamb market.

FR RÉSUMÉ

Les moutons, parmi les premiers animaux domestiqués par l'homme il y a environ 10-12 mille ans, ont bénéficié de nombreuses améliorations génétiques pour optimiser la production de viande, de laine et de lait. Le séquençage en cours du génome des moutons, constitué de 54 chromosomes, permet de mieux comprendre et d'optimiser les traits économiques importants grâce à la sélection naturelle et artificielle. En 2022, le consortium Asul-Tulik a été créé dans le nord du Kazakhstan, réunissant des éleveurs de moutons et des prestataires de services pour faire avancer les races locales. L'objectif du consortium est de produire de l'agneau de haute qualité pour les marchés national et international en développant une lignée de

moutons hybrides avec des caractéristiques souhaitables telles qu'un poids vif élevé et une adaptabilité régionale. Cette initiative se concentre sur les techniques modernes de reproduction et les biotechnologies de reproduction, y compris l'insémination artificielle avec du sperme importé, pour créer des agneaux précoces. En répondant aux défis de la reproduction saisonnière et en intégrant l'élevage de précision, le consortium vise à produire des agneaux de qualité supérieure, écologiques, et à établir une marque nationale forte, contribuant au développement rural et renforçant la position du Kazakhstan sur le marché mondial de l'agneau.

ملخص AR

مميزة مثل الوزن الحي المرتفع والتكيف الإقليمي. يركز هذا المشروع على تقنيات التربية الحديثة والتكنولوجيا الحيوية التناسلية، بما في ذلك التلقيح الصناعي باستخدام السائل المنوي المستورد، لخلق حملات تنضج بسرعة. من خلال معالجة تحديات التكاثر الموسمي ودمج تقنيات تربية المواشي الدقيقة، يسعى التحالف إلى إنتاج لحوم ضأن صديقة للبيئة وممتازة الجودة، وإنشاء علامة تجارية محلية قوية، مما يساهم في تنمية المناطق الريفية وتعزيز مكانة كازاخستان في سوق لحوم الضأن العالمي.

تعد الأغنام من أول الحيوانات التي دجنها الإنسان قبل حوالي 10 إلى 12 ألف عام، وقد خضعت لتحسينات وراثية كبيرة لزيادة إنتاج اللحوم والصفوف والحليب. يساعد استمرار رسم خريطة الجينوم الخاص بالأغنام، والذي يتكون من 54 كروموسومًا، في فهم وتحسين الصفات ذات الأهمية الاقتصادية من خلال الانتقاء الطبيعي والصناعي. في عام 2022، تم إنشاء تحالف "أسول-توليك" في شمال كازاخستان، حيث جمع بين مربّي الأغنام ومقدمي الخدمات لتطوير سلالات الأغنام المحلية. يهدف التحالف إلى إنتاج لحوم ضأن عالية الجودة للأسواق المحلية والدولية من خلال تطوير خط من الأغنام المهجنة بصفات

SUDAN'S FOOD INSECURITY CRISIS: THE IMPACT OF CONFLICT AND DISRUPTED LOCAL CEREAL VALUE CHAINS ON HUNGER



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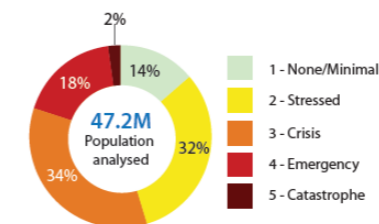
According to the last data from the Integrated Food Security Phase Classification (IPC)¹, Sudan is currently facing severe levels of acute food insecurity ever recorded in the country, with over half the population (25.6 million people) experiencing crisis-level conditions or worse. The situation is particularly dire in 10 states, including the five states of Greater Darfur, South and North Kordofan, Blue

Nile, Al Gezira, and Khartoum, where 755,000 people are facing catastrophic conditions (IPC Phase 5). The IPC's report highlights a sharp escalation in food insecurity compared to earlier assessments, with significant increase in both the number of people experiencing emergency-level food insecurity (74% up to 8.5 million) and those at risk of famine, especially in conflict-affected regions like Greater Darfur and Greater Kordofan.

Acute Food Insecurity (1st projection) | June - September 2024



Approximately 25.6M people across Sudan will likely experience high levels of acute food insecurity (IPC Phase 3 or above) between June and September 2024. Fourteen areas (localities and IDP/refugee clusters) in nine states face a risk of Famine during the same period.



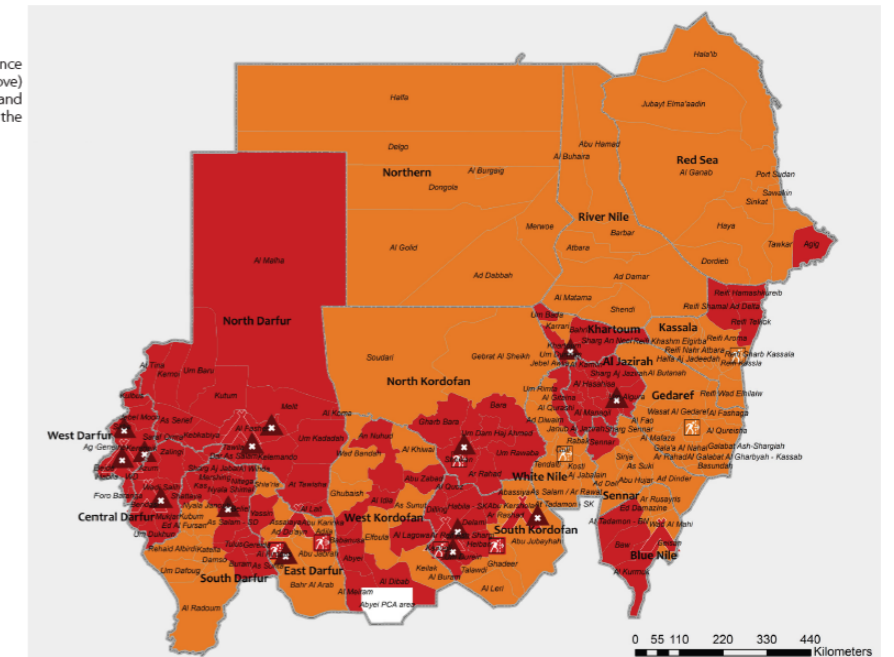
Key for the Map

IPC Acute Food Insecurity Phase Classification (mapped Phase represents highest severity affecting at least 20% of the population)



Map Symbols
 IDP/other settlements classification
 Risk of famine
 Refugees

Evidence Level
 ** Medium



Source: Sudan : Acute Food Insecurity Snapshot | April 2024 - February 2025, IPC Report (<https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1157066/?iso3=SDN>)

The ongoing conflict, which has entered its second year, has severely restricted humanitarian access, exacerbating the crisis and limiting effective response efforts. The conflict has pre-

cipitated widespread displacement and disturbances in supply routes, market operations, and agricultural production. Additionally, it has sharply curtailed access to vital humanitarian aid, in-

¹ IPC Acute Food Insecurity Analysis June 2024 - February 2025. Published on 22 July 2024. https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Sudan_Acute_Food_Insecurity_Jun2024_Feb2025_Report.pdf

tensifying an already critical situation in which the collapse of local production stems from the farming communities' inability to reach their farmlands, procure agricultural inputs, and participate in farming activities. This has resulted in significant food shortages and ongoing disruptions in the supply chain projected to extend into early 2025. United Nations FAO reports that cereal production in Sudan has fallen dramatically due to ongoing conflict, with yields of staple cereals like sorghum, millet, and wheat estimated to be more than 40 percent below the average of the last five years. This sharp decline is contributing to worsening food insecurity amid the conflict. Fields in El-Gezira State, traditionally a major agricultural area producing half of Sudan's wheat and 10 percent of its sorghum, have been turned into battlefields, further exacerbating the crisis.² The conflict in Sudan has drastically impacted the value chains for main staple food cereals, leading to a significant reduction in production. In 2023, national cereal output was about 4.1 million tonnes, a 46% decrease from the previous year and 40% below the five-year average. Sorghum production dropped to about 3 million tonnes (42% less than in 2022), millet output was approximately 683,500 tonnes (64% lower), and wheat forecasted for March 2024 was around 377,900 tonnes, reflecting a 20% decrease. These declines are primarily due to disrupted agricultural operations, insecurity, and the rising costs and scarcity of agricultural inputs.

A comprehensive analysis from the Special Report – 2023 FAO Crop and Food Supply Assessment Mission (CFSAM) to the Republic of the Sudan reveals a severe decline in agricultural productivity. Sorghum yield in 2023 fell to 0.51 tonnes/hectare, a significant drop due to erratic rainfall and limited access to agricultural inputs. Notably, millet yields also decreased drastically to 0.23 tonnes/hectare, especially in conflict-heavy areas like Greater Darfur and Greater Kordofan, impacting overall production levels. Wheat experienced a reduction as well, with production at 377,900 tonnes, down 20% from the previous year due to diminished planting areas. The national production figures for sorghum and millet combined stood at 3.74 million tonnes, down by 48% from 2022. This extensive reduction is largely attributed to ongoing conflicts that have disrupted traditional farming operations, compounded by the decreased availability and increased costs of agricultural inputs.³ The national cereal supply/demand balance for Sudan in 2024 illustrates severe disruptions in the cereal value chain. Opening stocks are estimated at 284,000 tonnes, with 226,000 tonnes of sorghum held by the private sector and 58,000 tonnes by the Strategic Reserve Corporation. Total food use is projected at 7.32 million tonnes, based on a population of 48.2 million, with per capita cereal consumption averaging 152 kg annually. Significant post-harvest losses, estimated at 191,380 tonnes, exacerbate the situation. Import requirements are forecasted at 3.38 million tonnes, predominantly wheat and sorghum, highlighting the critical dependency on imports to meet national food demands.⁴

On the other hand, several authors⁵ emphasize that the alarming rise in severe malnutrition is closely tied to the economic decline, manifesting in the scarcity of essential food items and prohibitive price increases, which render basic nutrition inaccessible for much of the population. This situation is particularly dire in conflict hotspots like the Darfur and Kordofan regions,

and the states of Khartoum and Al Gezira where agricultural output has significantly declined, and trade flows have been severely disrupted. These factors, coupled with escalating prices, have made food increasingly unattainable, exacerbating malnutrition, especially among vulnerable groups such as children, pregnant women, and the elderly. The crisis is expected to worsen without substantial interventions, as the ongoing economic instability continues to undermine the effectiveness of aid and government support systems. Furthermore, the interrelated impacts of conflict and climate change on local food markets and supply chains further complicate the food security crisis.

The disruptions in cereal value chains have been exacerbated by the scarcity and escalated costs of raw materials. The majority of firms experienced challenges in accessing these essential inputs, leading to increased prices. This situation was further complicated by the destruction of vital transport infrastructure and security issues, causing significant losses for farmers contracted to supply materials to processing firms and damage to stored raw materials due to power outages and theft during conflict-related raids.⁶ The conflict has substantially impacted the value chains, leading to a notable shrinkage of the labour force. Estimates⁷ suggest that the agrifood system could incur losses up to US\$ 2.2 billion if the conflict persists through the year, marking a 22% decrease from 2021. The agro-processing sector faces the steepest decline at 52%. Employment within the agrifood system could decrease by 0.6 million workers, a 23% drop from 2021, while outside the agrifood system, employment could decrease by 4.6 million workers, 59% lower than the previous year. Specifically, agriculture could see a reduction of approximately 20.4% in its workforce.

Besides the usual stable-time approach, and in addition to humanitarian support, localized support for cereal production and logistical distribution within the country is the achievable target for stakeholders. Enhancing the agricultural infrastructure and optimizing supply chains for essential cereals are key to improving food security in the short term. In Sudan, addressing food insecurity amidst ongoing conflicts necessitates an integrated approach that prioritizes the stabilization and development of the cereal value chain. Establishing early warning systems and enhancing the resilience of agricultural practices are essential. This involves not only immediate humanitarian aid but also substantial improvements in infrastructure such as water, agricultural inputs, and energy supplies. In the medium term, strengthening the capacity of local farmers through access to necessary agricultural inputs, modern irrigation techniques, and training can significantly boost cereal production, a critical step towards alleviating the bottlenecks in the processing and marketing.

Furthermore, reconstructing market infrastructure and establishing secure trade corridors are vital for the economic recovery of Sudan. Supporting dialogue between conflicting parties and safeguarding land rights can ensure the stability needed for agricultural activities. Ultimately, these efforts aim to increase the production and local procurement of staple cereals like sorghum and millet, reducing dependency on imports and reducing the immediate impact of hunger.

² <https://www.fao.org/newsroom/detail/sudan-cereal-production-down-by-over-40-percent-likely-exacerbating-hunger/en>

³ Special Report: 2023 FAO Crop and Food Supply Assessment Mission (CFSAM) to the Republic of the Sudan, 19 March 2024, <https://openknowledge.fao.org/server/api/core/bitstreams/8e198344-f214-46c5-bf37-26404fc9c9f/content>

⁴ Ibid, p.26.

⁵ Mohamed, Amira, and Anmar Homeida. "Hunger in the shadow of conflict: analyzing malnutrition and humanitarian challenges in Sudan." *Conflict and Health* 18.1 (2024): 50; Siddig, Khalid, et al. "Presentations for Sudan at a Crossroads: Food Systems, Hunger, and Humanitarian Aid During Civil Conflict." (2024).

⁶ Kirui, Oliver K., et al. *Armed conflict and business operations in Sudan: Survey evidence from agri-food processing firms*. Intl Food Policy Res Inst, 2023.

⁷ Siddig, Khalid, Mariam Raouf, and Mosab OM Ahmed. *The economy-wide impact of Sudan's ongoing conflict: Implications on economic activity, agrifood system and poverty*. Intl Food Policy Res Inst, 2023.

EN SUMMARY

Sudan faces severe food insecurity, with over half its population facing hunger, and areas like Greater Darfur and Greater Kordofan experiencing catastrophic conditions. This crisis, exacerbated by ongoing conflicts, has led to disruptions in cereal value chains, severely affecting agricultural output and market operations. The Food and Agriculture Organization (FAO) reports significant reductions in staple cereal yields, contributing to

heightened food insecurity and economic instability. Restoration efforts include enhancing agricultural infrastructure, improving market access, and supporting local farmers with inputs and training. Coordinated actions between conflicting parties, facilitated by trusted mediaries, are essential to stabilize the region and rebuild the agrifood system.

FR RÉSUMÉ

Le Soudan est confronté à une grave insécurité alimentaire, plus de la moitié de sa population souffrant de faim, et des régions comme le Grand Darfour et le Grand Kordofan connaissent des conditions catastrophiques. Cette crise, exacerbée par les conflits en cours, a conduit à des perturbations dans les chaînes de valeur des céréales, affectant gravement la production agricole et les opérations de marché. Selon l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO), les rendements des céréales de base ont diminué de manière significative, con-

tribuant à une insécurité alimentaire accrue et à une instabilité économique. Les efforts de restauration incluent l'amélioration des infrastructures agricoles, l'amélioration de l'accès aux marchés et le soutien aux agriculteurs locaux avec des intrants et des formations. Des actions coordonnées entre les parties en conflit, facilitées par des médiateurs de confiance, sont essentielles pour stabiliser la région et reconstruire le système agroalimentaire.

ملخص AR

في زيادة انعدام الأمن الغذائي وعدم الاستقرار الاقتصادي. تشمل جهود التعافي تعزيز البنية التحتية الزراعية، وتحسين الوصول إلى الأسواق، ودعم المزارعين المحليين بالمستلزمات والتدريب. تتطلب استعادة الاستقرار في المنطقة وإعادة بناء نظام الغذاء الزراعي جهودًا منسقة بين الأطراف المتنازعة، بوساطة أطراف موثوقة.

تواجه السودان أزمة حادة في الأمن الغذائي، حيث يعاني أكثر من نصف السكان من الجوع، وتواجه مناطق مثل دارفور الكبرى وكردفان الكبرى أوضاعًا كارثية. تفاقمت هذه الأزمة بفعل الصراعات المستمرة، مما أدى إلى تعطيل سلاسل القيمة للحبوب بشكل كبير، وأثر بشكل حاد على الإنتاج الزراعي وعمليات الأسواق. تشير تقارير منظمة الأغذية والزراعة (الفاو) إلى انخفاض كبير في إنتاج محاصيل الحبوب الأساسية، مما ساهم

UNLOCKING CAPITAL FOR AGRICULTURE: INNOVATIVE APPROACHES FOR SUSTAINABLE GROWTH



MR. AZAMAT KHAMIYEV,

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Agriculture plays a crucial role in ensuring food security and sustainable development, yet it faces significant financial and structural challenges, particularly in developing countries. This is especially true for the member states of the Organization of Islamic Cooperation (OIC), where agricultural productivity remains low despite the sector's importance. The limited development of food industries and a heavy reliance on food imports leave these countries vulnerable to global price fluctuations and supply chain disruptions.

These challenges are compounded by poverty, which affects 21% of the population in OIC countries and limits access to nutritious food. Economic instability, alongside the lack of specialized financial instruments for the agricultural sector, hinders growth. The limited availability of reliable financial resources prevents the adoption of innovations and modernization within agriculture, resulting in low revenues across agricultural industries. This exacerbates income inequality, as raw material producers receive disproportionately small shares, leading to a decline in profitability and extended investment payback periods, which further impede sustainable growth and technological progress in the sector.

Moreover, key potential growth drivers, such as small and medium enterprises (SMEs), are not effectively integrated into the economic cycle. SMEs face significant barriers to accessing finance, limiting their ability to adopt new technologies and fully realize their growth potential.

The Impact of Environmental Risks on Financing

Environmental threats, particularly climate change, present additional challenges that aggravate food security issues. The unpredictability of weather patterns, land degradation, and water shortages increase risks to agricultural production and negatively affect access to financing.

Addressing these challenges requires a comprehensive approach. This includes investments in research, the improvement of financial instruments, enhanced risk management strategies, the adoption of modern technologies, and the development of food industries. By implementing these measures, countries can reduce their dependence on imports and improve their resilience to ecological challenges. Modern strategies emphasize

expanding access to finance while adopting long-term, environmentally sustainable solutions for agricultural systems, ensuring the preservation of natural resources for future generations.

Innovative Financial Mechanisms for Sustainable Agriculture

Financing agricultural projects—particularly those focused on sustainable development—remains challenging due to the sector's high-risk perception. Agriculture's vulnerability to weather conditions, market price fluctuations, and seasonal production cycles, combined with high interest rates and limited collateral for small farmers, restricts access to affordable credit. Additionally, fragmented supply chains hinder the scaling of agricultural production to levels that would attract private investment. Consequently, many financial institutions hesitate to invest in this sector due to its complexity and associated risks.

In response to these challenges, several innovative financial mechanisms have emerged to promote sustainable agricultural practices, provide new sources of income for farmers, reduce investment risks, and catalyze private capital.

Carbon and Biodiversity Credits

Carbon and biodiversity credits have become effective tools for financing sustainable agriculture. Farmers who reduce carbon emissions or contribute to biodiversity conservation can sell these credits to companies looking to offset their environmental footprint. While carbon credits are already widely used in many markets, biodiversity credits are gaining traction by rewarding farmers for conserving ecosystems. These credits provide a measurable and tradable mechanism that monetizes environmental protection efforts, creating new revenue streams and encouraging sustainable practices. Companies, especially those with emission reduction targets, are increasingly purchasing these credits as part of their environmental strategies.

Sustainability-Linked Bonds (SLBs)

SLB tie capital costs to the achievement of specific environmental or social goals. For example, agribusinesses can issue SLBs that offer lower interest rates when targets, such as improved water usage or reduced greenhouse gas emissions, are met. These bonds incentivize companies to prioritize sustainable

development throughout their supply chains. SLBs represent an innovative approach to aligning financial and sustainability objectives, driving investments in long-term, environmentally responsible projects. This model is particularly relevant for agribusinesses, where supply chains significantly impact the environment.

Blended Finance

Blended finance combines public or philanthropic capital with private investments to reduce the risks of agricultural projects, particularly in high-risk regions. Public funds often provide guarantees or cover initial losses, making private investments more attractive. For instance, in climate-resilient agriculture, blended finance has proven effective in attracting investments by mitigating initial risks, which are typically higher in developing countries. This model is also increasingly used in renewable energy, biodiversity conservation, and sustainable agriculture.

Debt-for-Nature Swaps

Debt-for-nature swaps are an innovative mechanism in which a portion of a country's external debt is forgiven in exchange for commitments to invest in environmental conservation. For example, Belize successfully reduced its debt by 12% of GDP through an agreement focused on marine conservation. This approach allows countries with high debt and rich biodiversity to redirect funds toward environmental protection rather than debt servicing. These agreements offer significant opportunities for countries with substantial debt and valuable natural resources. By linking debt relief to sustainable development goals, nations can attract investment while preserving their natural assets.

Parametric Insurance

Parametric insurance, which provides payouts based on predefined natural events (such as droughts or floods), is gaining popularity in the agricultural sector. This innovative insurance model reduces uncertainty for both farmers and financiers by offering a clear risk management mechanism, ensuring timely responses to agricultural disruptions.

The Role of Islamic Finance in Agriculture

Islamic finance, based on principles of shared risk and community focus, offers unique opportunities for financing sustainable agriculture. Instruments such as Mudaraba (profit-sharing) and Musharaka (partnership) foster equitable and sustainable financial relationships between investors and farmers, promoting long-term stability and growth in the agricultural sector.

The Role of Digitalization in Agriculture

Digital technologies are transforming approaches to agricultural financing. Blockchain and other digital platforms enhance transparency in supply chains, enabling farmers to access financing by verifying sustainable practices. These platforms also connect farmers with a broader range of investors and provide real-time data on market conditions, improving decision-making and access to financial resources. Furthermore, successful examples from OIC member states, such as digital warehouse receipts and agricultural receipts, allow farmers to use stored goods and future harvests as collateral to secure capital.

IoT in Agriculture

The Internet of Things (IoT) generates valuable data on agricultural productivity, enabling more accurate risk assessments.

This data can be used to develop insurance products and provide real-time feedback to farmers, improving supply chain management and optimizing farming practices.

Conclusion

The challenges of financing agriculture, particularly in the context of sustainable development, are significant but manageable. As awareness of environmental risks such as biodiversity loss and land degradation grows, new approaches to agricultural finance are emerging. The interconnectedness of climate change and ecosystem loss underscores the necessity of addressing these risks to ensure the long-term sustainability of agricultural projects.

Environmental risks can substantially impact the valuation of agricultural assets, especially for small-scale farmers. By integrating ecological risks into financial assessments, lenders and insurers can better manage uncertainties, providing safer and more accessible financial products.

Innovative financial mechanisms—such as carbon and biodiversity credits, sustainability-linked bonds, blended finance, debt-for-nature swaps, and digitalization—offer new opportunities for agricultural development. These models not only reduce risks for investors but also create new income streams for farmers, supporting the transition to sustainable farming practices.

By adopting these financial tools and approaches, the agricultural sector can mitigate risks related to climate change, improve productivity, and foster long-term sustainability. Expanding access to these solutions, particularly in developing countries, is crucial to ensuring a resilient and inclusive future for global agriculture.

EN SUMMARY

This article named "Unlocking Capital for Agriculture: Innovative Approaches for Sustainable Growth" examines innovative financial mechanisms aimed at addressing the challenges faced by agriculture, particularly in OIC member states. It highlights the sector's low productivity, dependence on food imports, and limited access to finance, exacerbated by poverty and environmental risks, such as climate change. The role of Islamic finance and

digital technologies is also emphasized in enhancing transparency and increasing investment opportunities. The article calls for a comprehensive approach to promoting sustainable agriculture and improving the investment appeal of the agricultural sector in OIC member states.

FR RÉSUMÉ

Cet article intitulé « Déverrouiller le Capital pour l'Agriculture : Approches Innovantes pour une Croissance Durable » examine les mécanismes financiers innovants destinés à relever les défis auxquels est confrontée l'agriculture, en particulier dans les États membres de l'OIC. Il met en lumière la faible productivité du secteur, sa dépendance aux importations alimentaires et l'accès limité aux financements, aggravés par la pauvreté et les

risques environnementaux tels que le changement climatique. L'article souligne également le rôle de la finance islamique et des technologies numériques dans l'amélioration de la transparence et l'augmentation des opportunités d'investissement. Il appelle à une approche globale pour promouvoir l'agriculture durable et améliorer l'attractivité du secteur agricole dans les États membres de l'OIC.

ملخص AR

التمويل، والتي تتفاقم بسبب الفقر والمخاطر البيئية مثل تغير المناخ. كما تبرز المقالة دور التمويل الإسلامي والتقنيات الرقمية في تعزيز الشفافية وزيادة فرص الاستثمار. تدعو المقالة إلى تبني نهج شامل لتعزيز الزراعة المستدامة وتحسين جاذبية الاستثمار في القطاع الزراعي في الدول الأعضاء في منظمة التعاون الإسلامي.

تستعرض هذه المقالة بعنوان "تحرير رأس المال للزراعة: نهج مبتكرة لتحقيق النمو المستدام" الآليات المالية المبتكرة التي تهدف إلى معالجة التحديات التي يواجهها القطاع الزراعي، لا سيما في الدول الأعضاء في منظمة التعاون الإسلامي. وتسلسل الضوء على انخفاض إنتاجية القطاع، واعتماده الكبير على استيراد الغذاء، والقيود المفروضة على الوصول إلى

TECHNOLOGICAL ADOPTION AND NATIONAL STRATEGIES FOR FOOD WASTE MANAGEMENT IN ARABIC-SPEAKING COUNTRIES



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Introduction

Food Waste and Loss (FWL) is a major issue affecting food security, sustainability, and economic stability in OIC MS. The region has seen substantial efforts to address these challenges through national strategies and innovative technologies.

This study uses a combination of qualitative data, policy documents, and case studies, along with quantitative data representing the economic impact of food waste in the region from regional workshops organized by IOFS in May 2024, in Rhyah, KSA with the support of the Ministry of Environment, Water and Agriculture. The workshop emphasized the "Gene to Fork" modality of IOFS, focusing on sustainable agriculture, food safety, and efficient resource management. The outcomes highlighted the need for better coordination between food waste and safety policies, investment in technologies for food edibility assessment, and enhanced capacity among participants for informed decision-making and policy formulation. The timeline of technological adoption and national strategies is visualized through graphs and chronological analysis of major events.

According to UN FAO, over one-third of the food produced globally is lost or wasted annually, amounting to approximately 2.5 billion tons, which equates to 24% of the global food supply by energy content and is worth roughly \$230 billion. This lost food could potentially feed about 2 billion people, with one-quarter of the food lost or wasted capable of feeding 870 million hungry people. The impact of FLW extends to environmental concerns, as it contributes significantly to greenhouse gas emissions, making it the third-largest emitter, if it were a country with a global carbon footprint of 3.3 gigatons of CO₂. The water used annually to produce this lost or wasted food equals the annual flow of the Volga River or three times the volume of Lake Geneva¹. In OIC, Kuwait ranks second globally in per capita carbon footprint, with an estimated 6.21 tons of CO₂ per capita annually. Landfills cause environmental and groundwater pollution, and the soil in these landfills does not meet international standards, leading to high humidity and biological imbalance.

Several studies, particularly those focusing on households, have measured food waste within specific regions of a country, such as a state, province, or city. These sub-national studies include those that cover a mix of urban and rural areas. For instance, a study in China divides the country into broad geographical regions such as 'East China' (Zhang, 2020)², as well as studies, focused exclusively on urban areas, such as Beirut, Lebanon (Chalak, 2019)³. In such cases, applying per capita waste data collected from small regions to the entire country assumes that waste generation is comparable across regions and between rural and urban areas—likely inaccurate assumptions. Few studies have focused on rural waste, making it challenging to estimate the differences between urban and rural waste generation. However, the limited data available, such as a study by JICA (2015) in Gujranwala, Pakistan, which includes rural and urban households, suggest notable differences.

FLW occurs throughout the supply chain, with 44% lost before consumption and 34% wasted during consumption. Households are the major contributors to food waste, driven by overbuying, poor planning, and confusion over labels. According to the World Food Waste Index Report 2024, most global food waste originates from households. In 2022 alone, households were responsible for 631 million tonnes of food waste, accounting for 60% of the total, while the food service sector contributed 290 million tonnes, and the retail sector 131 million tonnes. This means that households waste at least one billion meals each day, with an average of 79kg of food wasted per person annually. Even with a conservative estimate of the edible portion of this waste, it equates to 1.3 meals per day for everyone worldwide affected by hunger⁴. Food waste is not just a problem for wealthy countries. With the expansion of data since the 2021 Food Waste Index Report, the average amount of food waste per person in households across different income levels has become more similar. The difference in average household food waste between high-income, upper-middle-income, and lower-middle-income countries is now only 7 kg per person per year.

1 UN FAO Report 2023
2 Hui Zhang, Huabo Duan, Jelena M. Andric, Mingwei Song, Bo Yang, Characterization of household food waste and strategies for its reduction: A Shenzhen City case study, Waste Management, Volume 78, 2018, Pages 426-433,
3 Chalak A, Abiad MG, Diab M, Nasreddine L. The Determinants of Household Food Waste Generation and its Associated Caloric and Nutrient Losses: The Case of Lebanon. PLoS One. 2019 Dec 3;14(12):e0225789. doi: 10.1371/journal.pone.0225789. PMID: 31794574; PMCID: PMC6890253.
4 <https://www.unep.org/resources/publication/food-waste-index-report-2024>

The economic impact of food waste in the region has been steadily increasing, from \$28 billion in 2010 to an estimated \$56 billion in 2024. The COVID-19 pandemic 2020 exacerbated the issue by disrupting supply chains and increasing food loss, adding pressure to fragile food systems. The average amount

among 16 member states, including Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Oman, Qatar, Kingdom of Saudi Arabia, Sudan, Tunisia, the United Arab Emirates, Palestine, and Yemen were presented (Figure1).

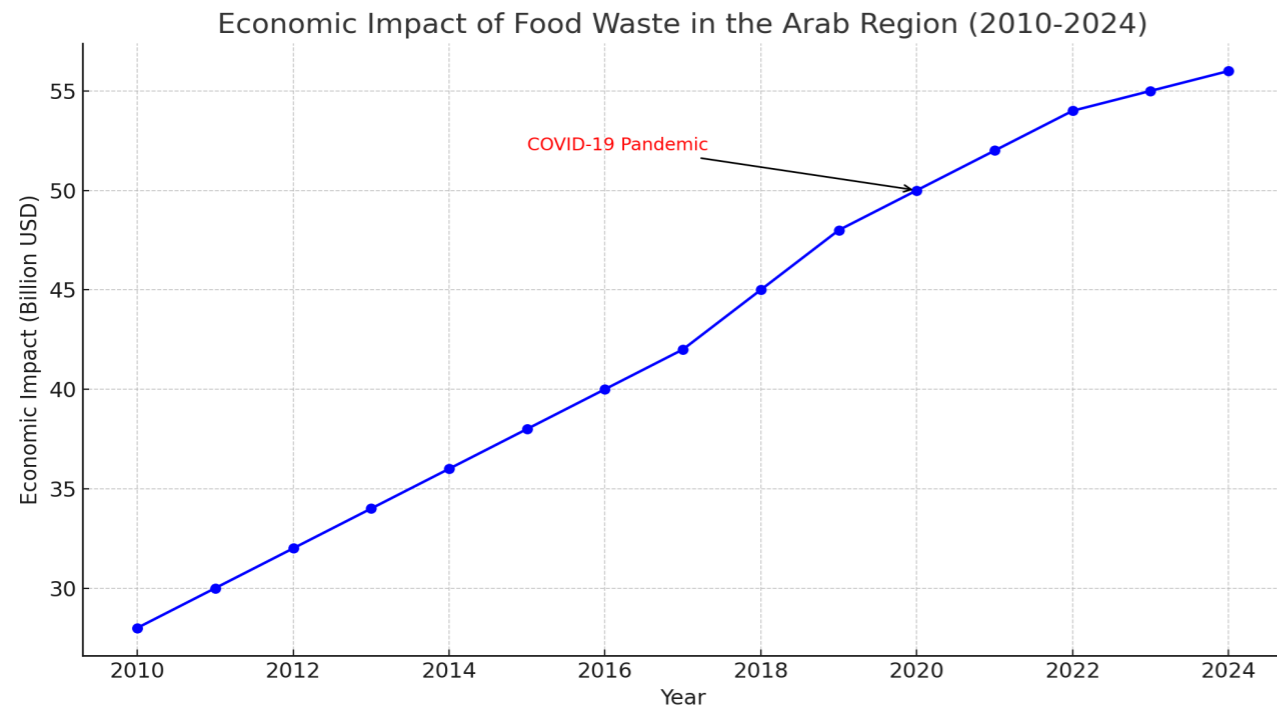


Figure 1: Economic Impact of Food Waste in the Arab Region⁵ (2010-2024)

Logistical inefficiencies, inadequate storage, and poor transportation are key contributors to these losses. The Arab Organization for Agricultural Development (AOAD) emphasized that these challenges are worsened by external crises like the COVID-19 pandemic and the Ukraine-Russia conflict, which have further strained the food systems in the region.

However, the challenge of creating a unified methodology for estimating food waste across households, supply chains, food service industries, and hospitals remains unresolved. Few countries have collected robust food waste data, which is crucial for understanding the scale of the problem, identifying hotspots, and assessing the effectiveness of interventions. Despite the abundance of household studies, only a handful are suitable for tracking progress toward SDG 12.3 (half per capita global food waste) at the national level, and data coverage in the retail and food service sectors is still limited. This underscores the need to improve methodologies and research efforts within MS to ensure reliable data and develop clear policies aimed at reducing food waste across all levels of consumption.

the Economist Food Sustainability Index, in its 2017 edition, compared global averages of FWL for various Arab countries. While MS including Egypt, Jordan, Lebanon, Morocco, Saudi Arabia, Tunisia, and the UAE exhibited elevated levels of food loss and waste, several countries continue to grapple with challenges related to undernutrition and micronutrient deficiencies.

Comparing the Food Waste Index (FWI) and the Food Sustainability Index (FSI), based on the most recent data from 2018, reveals significant insights. The FSI and FWI were analyzed with a focus on the crucial pillar of Food Loss and Waste in the KSA, with higher scores indicating a more sustainable food and nutrition system and progress toward achieving food sustainability.

Among these countries, Saudi Arabia emerges as the top performer in, Food Sustainability Index despite its substantial volume of food waste at the end-user level (retail and household), averaging 250 kg per person per year. Saudi Arabia outperforms its regional counterparts in terms of the effectiveness of its response to this issue. Additionally, the country benefits from a well-developed road network and significant infrastructure investments, resulting in relatively lower food losses at the pre-market stage.

On the other hand, the UAE faces challenges in both pre-market food losses and end-user food waste, positioning it unfavorably in the Food Sustainability Index (FSI) rankings. The per capita food waste in the UAE is exceptionally high at 986 kg per year, making it the highest among the 34 countries included in the study.

Further research conducted in 2018 reveals significant variations in household-level food waste across the Arab region. Seven quantitative studies focused on Iraq, Oman, the United Arab Emirates, and the State of Palestine, while three studies examined food waste in the hospitality industry in Saudi Arabia,

⁵ It should be noted that confidence ratings are an assessment – based on our understanding of the study – of how robust the estimate of food waste is for tracking food waste in the given country, not a judgment on the quality of the study undertaken. In many cases, food waste measurement was not the aim of the original study.

Egypt, and Jordan. These studies indicate that household-level food waste varies widely: from 68 to 150 kg per person per year in Oman, 62 to 76 kg per person per year in Iraq, 194 to 230 kg per person per year in Palestine, and 177 to 400 kg per person per year in the United Arab Emirates.

Beyond food being discarded due to perceived safety concerns, date labels on packaging also contribute significantly to food wastage. Tsiros and Heilman found that a large portion of con-

sumers (ranging from 69% to 84%, depending on the product) believe that perishable goods degrade in quality over time⁶. The confusion between 'Use-by' and 'Best-before' date codes leads to unnecessary disposal of fresh food by over 80% of consumers. A 2016 study by the Harvard Food Law and Policy Clinic revealed that 84% of consumers admitted to discarding food once it reached the date printed on the label, whether it was necessary or not.

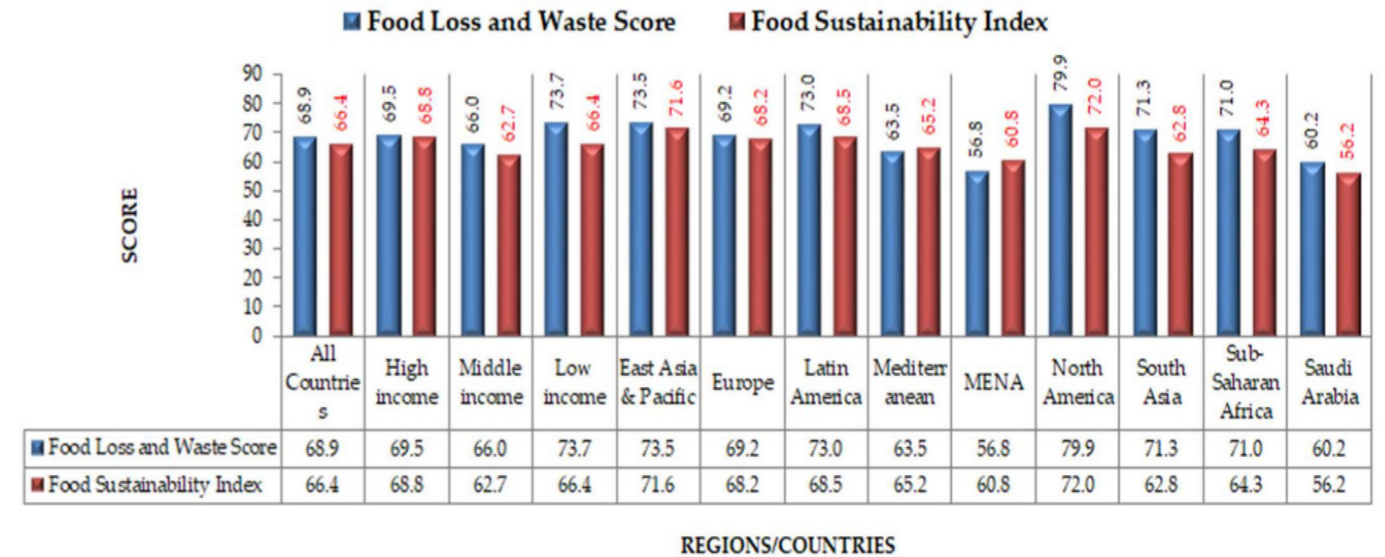


Figure 2. Comparison of Food sustainability index (FSI) and food waste and loss score (FWL) at the regional and country levels

At the same time, a strong correlation was observed between temperature and food waste, particularly in Arabic-speaking countries, which are generally hotter. These countries tend to have higher per capita food waste in households, possibly due to the increased consumption of fresh foods with substantial inedible parts and the lack of a robust cold chain. Higher seasonal temperatures, extreme heat events, and droughts exacerbate the challenges of storage, processing, transportation, and selling food safely, often resulting in significant volumes of food being wasted or lost.

Technological advancements to reduce FWL

In response to these high levels of food waste, technological advancements have emerged to help consumers make more informed choices, ultimately reducing waste. Innovations such as intelligent packaging and smart labels equipped with sensors or indicators monitor food conditions and freshness in real time (Morrison, 2020a). For example, labels, featuring temperature-sensitive indicators that change texture as food freshness declines, have sparked consumer interest to ensure freshness and potentially reduce waste, despite the prevalent reliance on expiration dates and sensory cues like color.

Adopting advanced technologies has played a crucial role in reducing food waste in the region. Technologies such as AI for crop assessment, Cool Bot systems for post-harvest cooling, and drones for monitoring agricultural production have been integrated into national efforts to improve food system efficiency.

The timeline graph depicts the adoption of key technologies across different countries:

- AI in Crop Assessment (2015): Adopted by Saudi Arabia, Jordan, and Egypt to optimize agricultural productivity.
- Cool Bot Systems (2017): Implemented in Egypt and Oman to manage post-harvest cooling and reduce spoilage.
- Drones for Monitoring (2018): Utilized in Saudi Arabia and the UAE for precision agriculture and efficient monitoring.
- Advanced Irrigation Systems (2020): Adopted in Oman, Kuwait, and Sudan to manage water resources and reduce food waste caused by inefficient irrigation.

Each of these technologies has been crucial in improving food security and reducing waste along the supply chain.

UN FAO is making significant strides in addressing FWL and proposes several initiatives including the use of AI and drones to determine water and nutrition requirements during production, machine vision technology to assess crop maturity at harvest, and Cool Bot technology for efficient field heat removal and modified atmospheric conveyance during postharvest stages. Additionally, digital platforms, blockchain technology, and advanced genetics are being employed to enhance overall efficiency in the food supply chain.

The FAO also strongly advocates for the adoption of framework legislation specific to food loss and waste (FLW), which would set clear responsibilities and binding targets. This includes the establishment of food donation systems, clear date labeling requirements, and the development of adequate institutional frameworks to support these initiatives.

⁶ Tsiros, Michael and Carrie Heilman The Effect of Expiration Dates and Perceived Risk on Purchasing Behavior in Grocery Store Perishable Categories» Journal of Marketing, 69 (2), 114-129.

Technological Adoption in Food Waste Management (2010-2024) with Countries

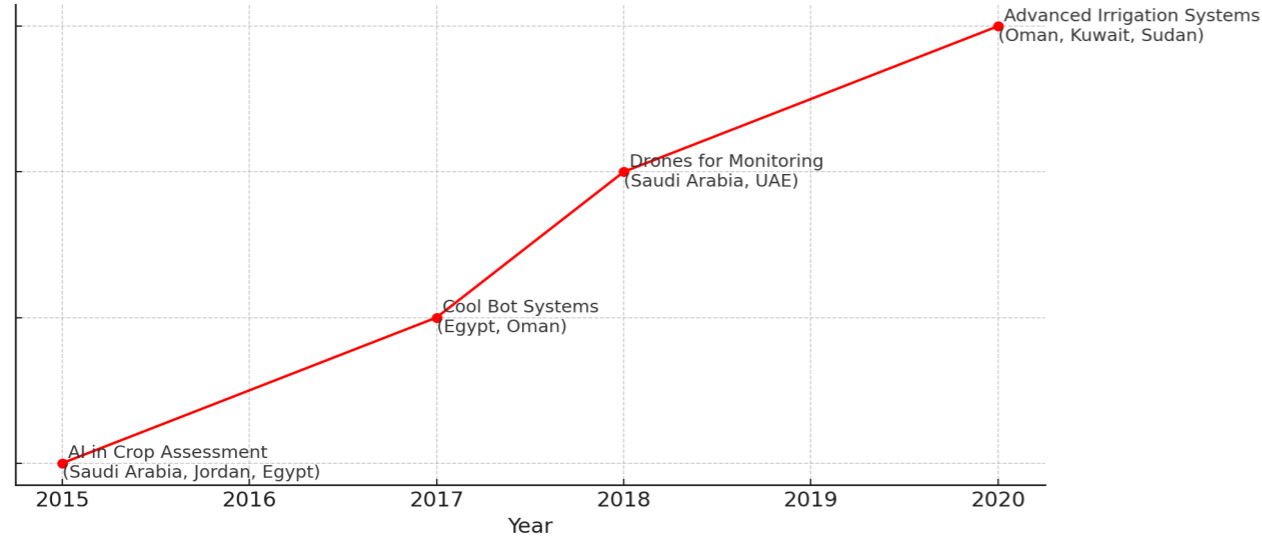


Figure 3: Technological Adoption in Food Waste Management (2010-2024)

In addition to these technological and legislative efforts, the FAO guide emphasizes the importance of individual actions in making a significant impact on food waste prevention and reduction. The guide offers practical recommendations, such as smart shopping, food storing, using leftovers, raising awareness, and improving disposal practices of food waste utilization.

Conclusion

Despite the numerous reports dedicated to estimating food waste and loss (FWL) at household, national, and regional levels, the lack of comprehensive data and a standardized methodology presents significant challenges. Estimating food waste for each country across the three sectors under consideration required trialing multiple methods to determine the most accurate and appropriate approach, given the nature of the available data.

However, due to low data coverage, particularly outside high-income countries (HICs), the method used for households differs from that for the other sectors, which suffer from limited data.

This scarcity results in low accuracy and a “Very Low” confidence level for non-household sector estimates, reflecting the substantial assumptions necessary to generate these figures. These estimates provide only an approximate indication of the problem’s scale and should be interpreted cautiously. Without more robust data, it is impossible to confidently determine whether these estimates overstate or understate the true extent of food waste.

The efforts to reduce food waste across Arabic speaking member states of the OIC have shown significant progress over the past decade. The combination of national strategies and technological adoption has provided a foundation for sustainable food systems, though challenges remain in scaling these efforts and addressing the growing economic impact. Future initiatives should focus on encouraging the broader adoption of advanced technologies in countries that have yet to integrate them and fostering greater collaboration between OIC member states to share best practices and accelerate progress in reducing food waste.

EN SUMMARY

This article examines the adoption of key technologies and the implementation of national strategies for reducing food waste and loss (FWL) in Arabic-speaking Member States (MS) of the Organization of Islamic Cooperation (OIC). By analyzing data from 2010 to 2024, the study identifies significant milestones

in both policy development and technological innovation across the region. The research highlights the economic impact of food waste, the role of public awareness campaigns, and the introduction of advanced technologies such as AI for crop assessment and Cool Bot systems.

FR RÉSUMÉ

Cet article examine l’adoption des technologies clés et la mise en œuvre des stratégies nationales pour réduire le gaspillage et les pertes alimentaires (FWL) dans les États membres arabophones de l’Organisation de la Coopération Islamique (OIC). En analysant les données de 2010 à 2024, l’étude identifie des étapes significatives dans le développement des politiques et

l’innovation technologique à travers la région. La recherche met en lumière l’impact économique du gaspillage alimentaire, le rôle des campagnes de sensibilisation publique, ainsi que l’introduction de technologies avancées telles que l’IA pour l’évaluation des cultures et les systèmes Cool Bot.

ملخص AR

السياسات والابتكار التكنولوجي عبر المنطقة. يسلط البحث الضوء على التأثير الاقتصادي لهدر الطعام، ودور حملات التوعية العامة، وإدخال تقنيات متقدمة مثل الذكاء الاصطناعي لتقييم المحاصيل وأنظمة “كول بوت” للتبريد.

تستعرض هذه المقالة تبني التقنيات الرئيسية وتنفيذ الاستراتيجيات الوطنية لتقليل هدر وفقد الطعام (FWL) في الدول الأعضاء الناطقة بالعربية في منظمة التعاون الإسلامي (OIC). من خلال تحليل البيانات من 2010 إلى 2024، تحدد الدراسة معالم رئيسية في كل من تطوير



IOFS NEWS OVER JULY-AUGUST-SEPTEMBER



IOFS Director General's Working Visit to Almaty

On July 1, 2024, His Excellency Ambassador Berik Aryn, Director-General of the Islamic Organization for Food Security (IOFS), visited Almaty to strengthen collaboration with local agricultural research institutions and academic leaders. His first stop was at Al-Farabi Kazakh National University (KazNU), where he engaged in productive discussions with Dr. Zhanseit Tuimebayev, the university's rector, and his delegation. The visit continued with a meeting at the Kazakh Scientific Research Institute of Animal Husbandry and Forage Production, where Dr. Aibyn Torekhanov presented the institute's extensive gene pool of over 5,000 fodder crops and its pivotal role in livestock and feed research. Ambassador Aryn also met with Dr. Raushan Ramazanova from

the Kazakh Research Institute of Soil Science and Agrochemistry, focusing on enhancing soil fertility and sustainable agricultural practices. His final engagement was with Dr. Sholpan Bastaubayeva at the Kazakh Research Institute of Agriculture and Plant Growing, which has been instrumental in developing competitive crop varieties since its establishment in 1934. These meetings underscored the commitment to advancing food security initiatives in Kazakhstan through collaborative research and innovation.



IOFS Director General receives award from the Government of Kazakhstan

On July 2, 2024 H.E. Ambassador Berik Aryn, IOFS Director General, was awarded the Nazir Turekulov Medal for his contributions to the development of Kazakhstan's foreign policy. The medal, named after the esteemed Kazakh diplomat Nazir Turekulov, was presented by H.E. Murat Nurtleu, Deputy Prime Minister and Minister of Foreign Affairs of Kazakhstan, during the country's Day of Diplomatic Service celebrations.



IOFS Director General Participates in the 24th Summit of the Shanghai Cooperation Organization



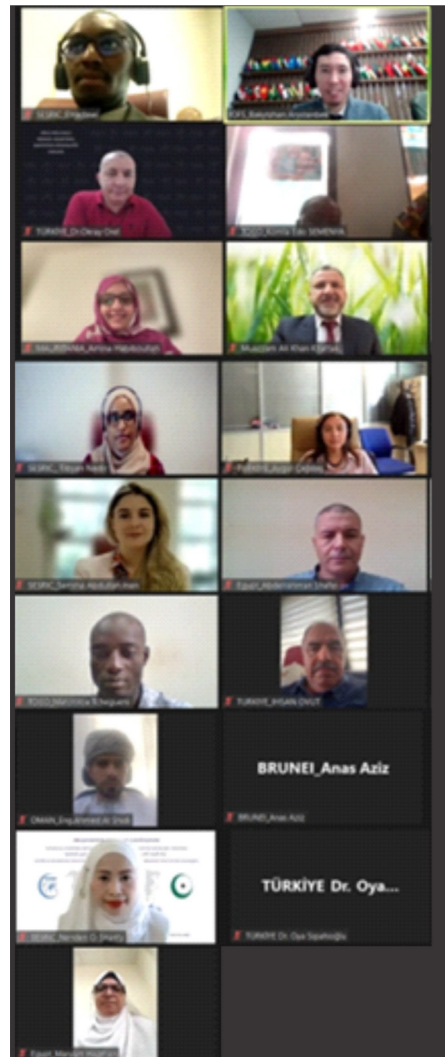
IOFS Conducts Webinar on Animal Forage Production in Collaboration with the Kazakh National Chamber of Entrepreneurs

On 2 July 2024, IOFS in collaboration with the Kazakh National Chamber of Entrepreneurs, Atameken, successfully hosted a webinar on Animal Forage Production, with a focus on Alfalfa. Prof. Ahmed Tamkoc from the Turkish MEVKA Development Agency shared his extensive knowledge on Alfalfa Global and Regional Trends and detailed insights into Alfalfa Production in Turkiye. Local farmers specializing in Alfalfa hay and seeds production, along with other key industry stakeholders gained valuable insights of techniques and advancements in the field.



On 4 July 2024, the Shanghai Cooperation Organization (SCO) Plus summit commenced in Kazakhstan, chaired by President Kassym-Jomart Tokayev. Themed "Strengthening Multilateral Dialogue – Striving Towards Sustainable Peace and Prosperity." H.E. Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security, participated in this pivotal event, underscoring the essential link between food security and regional stability. The summit adopted the Astana Declaration, alongside 20 resolutions and three statements, focusing on various initiatives, including the call for global unity for peace. Prominent leaders, including Presidents Xi Jinping, Vladimir Putin, and Recep Tayyip Erdogan, attended the summit, alongside UN Secretary-General António Guterres. During the event, Ambassador Aryn engaged in discussions with key officials from Kyrgyzstan, Tajikistan, and other organizations, emphasizing international cooperation in advancing food security.

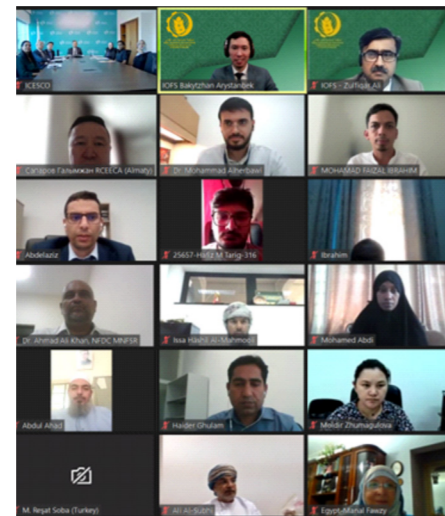
IOFS-SESRIC Webinar on Digitalisation in Food Security and Agriculture



On 9 July 2024 IOFS and the Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC) hosted a webinar focused on the transformative role of digitalization in food security and agriculture. Attended by 31 researchers and representatives from 11 OIC Member States, the event explored how artificial intelligence (AI) and data analytics can enhance agricultural development.

IOFS-ICESCO Webinar on Utilizing the Potential of Biochar for Soil Improvement and Sustainable Farming

On 10 July 2024, the Islamic Organization for Food Security partnered with the Islamic World Educational, Scientific and Cultural Organization (ICESCO) to conduct a webinar focused on biochar's potential for enhancing soil resilience and promoting sustainable farming practices. The event attracted 82 experts, academicians, and industry representatives from 19 OIC Member States.



13th IOFS Executive Board Meeting Convened in Astana



On the 11 July 2024, the 13th meeting of the Executive Board of the Islamic Organization for Food Security convened at the Organization's Headquarters in Astana, Kazakhstan. The Director General of IOFS, Ambassador Berik Aryn warmly welcomed the esteemed representatives of the Executive Board, including the Chairman - Dr. Masoud Jarallah Al-Marri from the State of Qatar, the Honorary Chairman - Eng. Abdulaziz A. Alhowaish from the Kingdom of Saudi Arabia, Deputy Minister of Foreign Affairs of the Republic of Kazakhstan - Mr. Alibek Bakayev, Mr. Mohammed Saeed Sultan Al Nuaimi from the United Arab Emirates, Mr. Amir Mohyuddin from the Islamic Republic of Pakistan, Mr. Fayzimakhmad Amonov from the Republic of Tajikistan, Mr. Maina Hamadou from the Republic of Cameroon (online) and Mr. Musa M. Humma from the Republic of The Gambia (online).

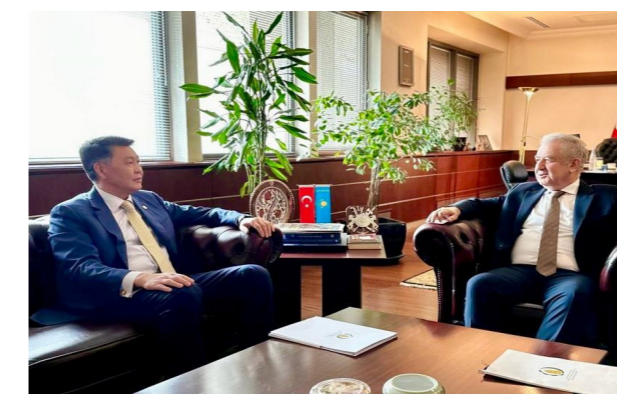
Director General of IOFS Meets with Minister of Water Resources and Irrigation of Kazakhstan

On 16 July 2024, Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security, met with Mr. Nurzhan Nurzhigitov, the newly appointed Minister of Water Resources and Irrigation of Kazakhstan. The discussion centered on the critical role of effective water management in ensuring food security, with Ambassador Aryn emphasizing the importance of establishing a dedicated ministry for water resources as part of Kazakhstan's development strategy. He highlighted the IOFS's mission and its Program for Water Management in Agriculture, which includes a project to create a Center for Flood Resilience aimed at helping agricultural communities mitigate flood impacts.



Islamic Organization for Food Security and Republic of Türkiye Reinforce Collaborative Efforts to Enhance Food Security

On 17 July 2024, the Islamic Organization for Food Security conducted a courtesy visit to the Embassy of the Republic of Türkiye in Astana to strengthen collaborative efforts in enhancing food security among Member States. During the visit, IOFS Director-General H.E. Ambassador Berik Aryn met with H.E. Mustafa Kapucu, the Turkish Ambassador to Kazakhstan, who congratulated Ambassador Aryn on his new role and expressed wishes for the IOFS's success in tackling global food security challenges, particularly in Organization of Islamic Cooperation (OIC) Member States. Ambassador Aryn acknowledged Türkiye's active participation in the IOFS and highlighted the country's crucial role in agricultural development through various initiatives by its Ministry of Agriculture and Forestry and the Turkish Cooperation and Coordination Agency (TIKA). He expressed interest in collaborating with Turkish institutions to build capacity in strategic commodities such as wheat, rice, and cassava.



IOFS and Algeria Discuss Strengthening Cooperation



On 19 July 2024, His Excellency Ambassador Berik Aryn, Director-General of IOFS, met with His Excellency Mr. Kamel Fenniche, Ambassador of the Algerian People's Democratic Republic, to discuss enhancing cooperation between IOFS and Algeria. Ambassador Aryn outlined IOFS's objectives and expressed a desire for Algeria to join as a Member State, emphasizing the benefits of collective efforts in promoting food security and sustainable agriculture, including innovative programs like the IOFS Gene-Bank, Food Banking, and Water Management.

UN-OIC Biennial General Meeting on Coordination Convenes in Astana

On 22 July 2024, the 16th UN-OIC Biennial General Meeting on Coordination commenced in Astana, Kazakhstan, hosted by the IOFS. This pivotal event marks a significant milestone in ongoing efforts to strengthen collaboration and coordination between the United Nations (UN) and the Organization of Islamic Cooperation (OIC). The three-day meeting, spanning from 22-24 July, featured intensive deliberations across three Working Sessions focused on key thematic areas crucial to the sustainable development agenda. Discussions encompassed political cooperation, economic and scientific collaboration, and initiatives addressing cultural, social, and humanitarian issues pertinent to Member States.





IOFS Signs Letter of Intent with FAO to Strengthen Collaboration

On the sidelines of the 16th UN-OIC Biennial General Coordination Meeting, a Letter of Intent (LoI) was signed by the Islamic Organization for Food Security, represented by its Director General, H.E. Amb. Berik Aryn, and the Food and Agriculture Organization of the United Nations (FAO), represented by Assistant Director General, Mr. Abdul Hakim Elwaer on behalf of H.E. Mr. Qu Dongyu, FAO Director General. The LoI underscores the mutual intent of FAO and IOFS to finalize formal agreements in the future, detailing joint cooperation efforts. Initially, these efforts will be country-based and focused on areas such as

value chain development, food security governance, sustainable livestock development, and water management. These collaborations aim to leverage each Organization's expertise and resources to achieve tangible outcomes in enhancing food security and nutrition across common Member States.



IOFS Signs MoU with OIC Labour Centre

On 22 July 2024, the Islamic Organization for Food Security and the OIC Labour Centre (OIC LC) signed a Memorandum of Understanding (MoU) in Astana, Kazakhstan, to enhance cooperation in food security, agriculture, and rural development. The signing ceremony took place during the 16th UN-OIC Biennial General Coordination Meeting, highlighting a shared commitment to benefit OIC Member States socio-economically. The MoU, signed by H.E. Ambassador Berik Aryn of IOFS and H.E. Mr. Azar Bayramov of OIC LC, outlines a framework for collaborative activities, including knowledge exchange and capacity building in food security and labor issues, implementation of training programs for agricultural skills and safety, advocacy for improved labor rights, job creation initiatives in the agricultural sector, and promotion of gender equality and youth empowerment. This partnership reinforces their dedication to sustainable food security and rural development across OIC Member States.



Director General of IOFS Holds Bilateral Meetings at 16th UN-OIC Biennial General Coordination Meeting in Astana

On 22 July 2024, Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security, participated in productive bilateral discussions during the 16th UN-OIC Biennial General Coordination Meeting in Astana, Kazakhstan. These meetings highlighted IOFS's commitment to enhancing collaboration on critical regional and global challenges related to food security and sustainable development. Key discussions included a meeting with Prof. Ahmad Sengendo, OIC Assistant Secretary-General for Economic Affairs, focusing on strengthening economic cooperation among OIC member states to bolster food security and agricultural sustainability.



Ambassador Aryn also met with Ambassador Hameed A. Opeloyeru, OIC Permanent Observer to the UN, to enhance IOFS's advocacy for food security and sustainable development goals within the UN framework. Additionally, discussions with Prof. Noura Zaid Alrshoud, Executive Director of the Independent Permanent Human Rights Commission, explored potential collaborations to align food security initiatives with human rights principles. These engagements reaffirm IOFS's dedication to fostering partnerships that contribute to the socio-economic advancement of its Member States.



Director General of IOFS Continues Productive Bilateral Meetings on Sidelines of 16th UN OIC Biennial General Coordination Meeting

On 23 July 2024, Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security, continued productive bilateral discussions on the sidelines of the 16th UN-OIC Biennial General Coordination Meeting. Bilateral Meetings included a discussion with Mr. Ihsan Övüt, Secretary General of the Standards and Metrology Institute for Islamic Countries (SMIIC), where both parties confirmed their commitment to joint initiatives and IOFS's participation in the upcoming 10th World Halal Summit in Istanbul. With Dr. Ibrahim Ali Shoukry, Head of the Islamic Development Bank (IsDB) Regional Hub Kazakhstan, they explored sustainable

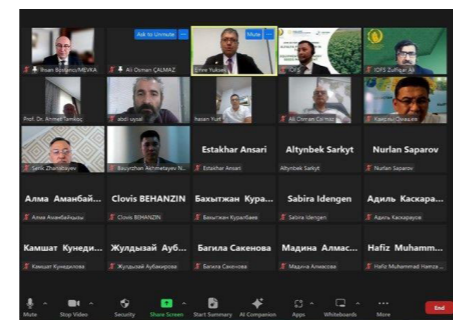
partnerships, with IsDB expressing readiness to support IOFS in capacity-building programs. Discussions with Dr. Abdul Hakim Elwaer from the FAO emphasized collaboration in water management and food security governance, while Dr. Dina Saleh from IFAD presented opportunities for joint initiatives to improve agricultural productivity and rural livelihoods. Finally, a meeting with Ms. Zehra Zumrut Selcuk of SESRIC focused on future projects related to digital and climate-smart farming. These engagements underscore IOFS's dedication to fostering strategic partnerships to achieve sustainable agricultural development and food security across OIC Member States.





IOFS Delivers Third Webinar on Alfalfa Animal Forage Production

On 24 July 2024, the Islamic Organization for Food Security partnered with the National Chamber of Entrepreneurs of Kazakhstan "Atameken", and the Turkish Mevlana Kalkinma Ajansı | Mevlana Development Agency to conduct its third webinar on Animal Forage Production, focusing specifically on alfalfa. The webinar featured in-depth discussions on crucial topics such as seed management and cutting-edge machinery for alfalfa cultivation.



IOFS Director General Meets with Iranian Ambassador to Kazakhstan

On 26 July 2024, H.E. Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security, met with H.E. Mr. Ali Akbar Jowkar, Ambassador Extraordinary and Plenipotentiary of the Islamic Republic of Iran to Kazakhstan, at the IOFS headquarters. Ambassador Aryn congratulated Iran on its successful presidential election and emphasized the potential for Iran's agricultural expertise to enhance IOFS initiatives. He acknowledged Iran's significant role as one of the first signatories of the IOFS statute in 2013, which has facilitated agricultural investments and technological exchanges among OIC Member States.



IOFS Delegation visits A.I. Baraev Research and Production Center of Grain Farming

The Director General of the Islamic Organization for Food Security, H.E. Ambassador Berik Aryn visited the A.I. Baraev Research and Production Center of Grain Farming to explore potential initiatives and collaborative projects that could benefit the member states of the Organization of Islamic Cooperation. The meeting focused on how Kazakhstan, through its esteemed A.I. Baraev Center, can contribute to the agricultural development and food security objectives of OIC member states. Discussions highlighted the impressive advancements made by the Center in the development of high-quality wheat varieties, including those that are drought and heat tolerant, which are crucial for improving resilience and productivity in regions facing climatic challenges.



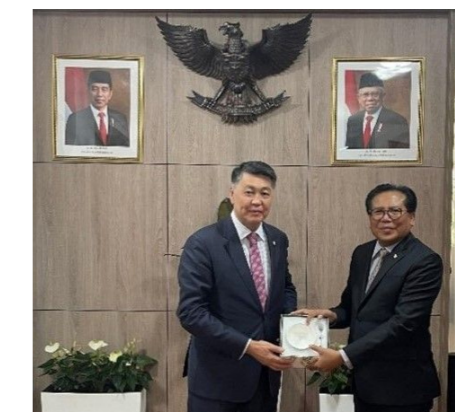
IOFS Received at the European Union Delegation in Astana for Potential Cooperation

On 2 August 2024, a delegation of the Islamic Organization for Food Security (IOFS) composed of Mr. Abdula Manafi Mutualo, Chief Multilateral Affairs Officer, Mr. Sofian Meddeb, Chief Countries Affairs Officer, and Mr. Emre Yuksek, Humanitarian Affairs Manager, was received at Office of the Delegation of the European Union (EU) to the Republic of Kazakhstan in Astana to exchange views on how to start bilateral cooperation within the framework of the Memorandum of Understanding that the Organization of Islamic Cooperation concluded with the EU in 2015.



IOFS Director General Meets with Ambassadors of Indonesia and Malaysia to Strengthen Cooperation

His Excellency Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security (IOFS), engaged in high-level meetings with His Excellency Mochamad Fadjroel Rachman, Ambassador Extraordinary and Plenipotentiary of the Republic of Indonesia to the Republic of Kazakhstan, and His Excellency Mohd Adli Bin Abdullah, Ambassador Extraordinary and Plenipotentiary of Malaysia to the Republic of Kazakhstan. The meetings took place at the respective embassies of Indonesia and Malaysia in Astana.



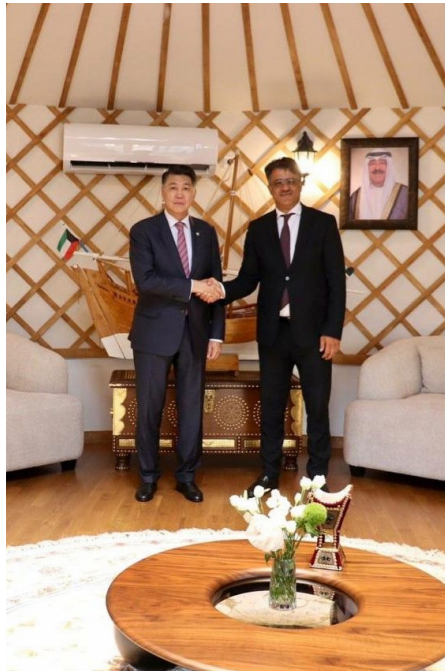
IOFS Financial Control Committee Concludes Review Meetings

On 16 August 2024, the Financial Control Committee of the Islamic Organization for Food Security, consisting of esteemed representatives from the Federal Republic of Nigeria, the Kingdom of Saudi Arabia and the Republic of Tajikistan successfully concluded a series of comprehensive meetings held from August 14th to 16th. The sessions were convened to evaluate the organization's financial health and operational efficiency.



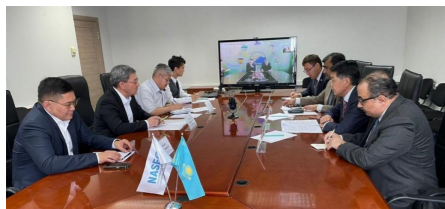
Director General of IOFS meets with Ambassador of the State of Kuwait

On 20 August 2024, His Excellency Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security, met with His Excellency Dr. Umar Ahmed Muhammed Murad Al-Kandari, Ambassador Extraordinary and Plenipotentiary of the State of Kuwait to Kazakhstan. The meeting focused on exploring prospects for strengthening collaboration to advance food security and agricultural development.



IOFS Strengthens Collaboration with NASEC

On 20 August 2024, the Director General of IOFS, H.E. Ambassador Berik Aryn, visited the National Agrarian Science Educational Centre (NASEC) to meet with Mr. Erzhan Ainabekov, Acting Chairman of the Governing Board of NASEC. The meeting was a significant opportunity to discuss and review the progress of several key initiatives aimed at bolstering food security and advancing agricultural resilience.



Meeting Between Director General of IOFS and Supreme Mufti of Kazakhstan Marks a New Chapter in Collaboration

On 21 August 2024, the Director General of the Islamic Organization for Food Security (IOFS), H.E. Ambassador Berik Aryn, held a meeting with the Chairman of the Spiritual Administration of Muslims of Kazakhstan, Supreme Mufti Nauryzbai kazhy Taganuly. The fruitful discussion underscored a shared commitment to enhancing cooperation and advancing key initiatives aimed at promoting food security and humanitarian aid.



IOFS Launched Project with Training on Biochar use for Sustainable Agriculture in Kazakhstan

On 28 August 2024, the Islamic Organization for Food Security (IOFS), in collaboration with the Islamic World Educational, Scientific, and Cultural Organization (ICESCO), officially launched the "Train Stakeholders on the Use of Biotechnology for Sustainable Farming: Harnessing the Potential of Biochar" project. Hosted by the Kazakh National Agrarian Research University (International Office KazNARU), this event marked a pivotal step in promoting sustainable agricultural practices across Central Asia. The event brought together a diverse audience of 62 participants, including 18 online, comprising researchers, academics, government officials, and industry representatives from four OIC Member States: Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan.



A key highlight was the Signing Ceremony for the Hand-Over Certificate of the Biochar Machine Prototype, signifying the formal transfer of the technology to support research and practical applications in the region. This initiative, the first of its kind in Kazakhstan, paves the way for the broader adoption of biochar technology across Central Asia.



11th December is Now the OIC Food Security Day as adopted by the 50th Session of the Council of Foreign Ministers in Yaoundé

On 30 August 2024, during the 50th Session of the Council of Foreign Ministers (CFM) of the Organization of Islamic Cooperation (OIC) in Yaoundé, Cameroon, it was officially adopted that December 11 will now be recognized as OIC Food Security Day. The session, themed "Developing Intra-OIC Transportation and Communication Infrastructure: Key Instrument for Combating Poverty and Insecurity," brought together Foreign Ministers from OIC Member States, as well as representatives of OIC Institutions, to discuss a wide range of topics, including political issues, the Palestinian cause, economic affairs, science and technology, cultural and social matters, and humanitarian concerns.



Among the over 100 resolutions adopted, the establishment of OIC Food Security Day was highlighted, commemorating the founding of the Islamic Organization for Food Security in 2013. The meeting also discussed the proposal for an IOFS Gene Bank to be hosted by Kazakhstan and the establishment of a Regional Center for Training on good agricultural practices, as proposed by Qatar. Additionally, the session marked the 50th anniversary of Cameroon's OIC membership and welcomed Turkiye's offer to host the next CFM in 2025.

High-Level Delegation Visits Egypt to Strengthen Capacity in Climate-Smart Agriculture and Organic Fertilizer Production

A high-level delegation comprising experts from Benin has embarked on a study visit to the Agriculture Research Institute, Ministry of Agriculture and Land Reclamation of the Arab Republic of Egypt from August 26 to 28, 2024. This visit is part

of a broader initiative aimed at enhancing the production and use of organic fertilizers in Africa through Climate-Smart Agriculture (CSA) practices. Over three days, the delegation will engage in an intensive program designed to provide insights into Egypt's advanced practices in managing agricultural and industrial waste for the production of organic fertilizers. The program includes visits to key research facilities, including the Central Laboratory for Organic Agriculture, and practical sessions at various production sites in Beheira and Sharqia regions.



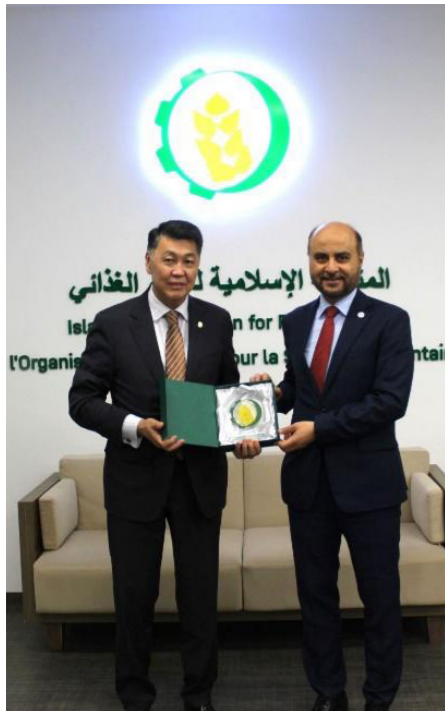
IOFS Concludes Biochar Application Training to Empower Kazakhstani Institutions for Sustainable Agriculture

The Islamic Organization for Food Security and the Islamic World Educational, Scientific, and Cultural Organization (ICESCO) successfully wrapped up the capacity-building segment of the "Train Stakeholders on the Use of Biotechnology for Sustainable Farming: Harnessing the Potential of Biochar" project at the Kazakh National Agrarian Research University (KazNARU). The training featured the handover of a biochar machine prototype to local institutions, marking a significant advancement in sustainable agriculture for the region. The second day included hands-on training with the biochar machine, where participants gained practical experience in biochar produc-

tion to enhance soil health and agricultural productivity. The sessions were led by international experts, including Dr. Ghulam Haider from Pakistan's National University of Sciences and Technology (NUST) and Dr. Ahmed H. El-Naggar from the International Center for Biosaline Agriculture (ICBA).



IOFS and OPEC Fund Discuss Strengthening Cooperation



On 3 September 2024, His Excellency Ambassador Berik Aryn, Director-General of the Islamic Organization for Food Security, welcomed His Excellency Abdulhamid Alkhalifa, President of the The OPEC Fund for International Development, to discuss potential areas of cooperation between the two institutions. The discussions focused on identifying specific areas where IOFS and the OPEC Fund could collaborate effectively. Both sides agreed on the importance of forging a strategic

partnership that leverages the strengths of both organizations to address critical challenges in food security. The meeting concluded with a mutual agreement to formalize this collaboration through a Memorandum of Understanding (MoU), which is expected to be signed in the near future. This MoU will define key areas of cooperation, setting the stage for joint initiatives aimed at enhancing food security and promoting sustainable development across the regions served by both institutions.

Empowering Sustainable Agriculture through Capacity Building on Soil Health

From 2-5 September 2024, as part of its ongoing commitment to enhancing food security in African countries, the Islamic Organization for Food Security has strengthened its collaboration with Nigerian farmers through a highly impactful training program on "Converting Agricultural Wastes to Organo-Mineral Fertilizers through Composting." This initiative not only underscores the IOFS's dedication to promoting sustainable agricultural practices among its Member States but also directly tackles the pressing challenge of soil degradation, a significant threat to food security, particularly in Africa.



Practical Training Empowers Farmers with Composting Techniques

From 2-5 September 2024, a training program in Nigeria brought together 40 farmers and agricultural professionals to learn practical techniques for transforming agricultural waste into organo-mineral fertilizers. The hands-on sessions highlighted the importance of using organic fertilizers as a sustainable alternative to

chemical fertilizers, which can lead to long-term soil degradation and environmental harm, adopting these composting techniques, participants were equipped to improve soil fertility, enhance crop yields, and reduce dependency on chemical inputs, contributing to more sustainable and environmentally friendly agricultural practices.



Director General of IOFS Delivers Keynote Address at International Forum on Food Security and Sustainable Development Goals

On 5 September 2024, H.E. Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security (IOFS), delivered a keynote address at the International Forum of Landlocked Developing Countries (LLDCs) focused on food security and the Sustainable Development Goals (SDGs). He highlighted the unique

challenges faced by landlocked nations, such as geographic isolation and limited market access, and called for targeted initiatives to address environmental vulnerabilities, food price volatility, and infrastructure limitations. Ambassador Aryn praised Uzbekistan's leadership in organizing the forum and acknowledged Tashkent's historical significance in food security.

On the sidelines, the Director General held meetings with key figures in agriculture, including:

Ibrokhim Abdurakhmonov, Minister for Agriculture of Uzbekistan: Discussed the IOFS mission and future collaboration opportunities.

Kurban Khakimzoda, Minister of Agriculture of Tajikistan: Expressed gratitude for Tajikistan's support and discussed ongoing joint efforts.

Dr. Tarifa Ajeif AlZaabi, Director General of the International Center for Biosaline Agriculture: Agreed on joint projects to enhance agricultural resilience.

Zafar Ziyaev, Director of the Scientific Research Institute of Plant Genetic Resources: Strengthened cooperation in plant genetic resources and research.

Sanoussi Hissaine, Director General of the Ministry of Agriculture of Chad: Explored collaboration prospects in food security.



Director General of IOFS, attended Partnerships and Investment Forum on Food Security in Tashkent

H.E. Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security (IOFS), participated in the Partnerships and Investment Forum on Food Security in Tashkent, Uzbekistan, on 6 September 2024. The forum gathered key international stakeholders to address food security challenges and explore in-

vestment opportunities. During the event, Ambassador Aryn held high-level bilateral meetings with notable officials, including Ms. Rabab Fatima from the UN, discussing potential collaborations in food security for landlocked developing countries and an invitation to the upcoming UN conference in Botswana. He also met with Mr. Torobayev Bakyt of Kyrgyzstan to highlight the importance of Kyrgyzstan's IOFS membership and extend an invitation to the IOFS General Assembly. Additionally, discussions with Mr. Alov Bakhromjon from Uzbekistan focused on enhancing regional cooperation, particularly regarding the Afghanistan food security program. These engagements reaffirmed a collective commitment to addressing global food security challenges through strengthened partnerships, with the IOFS dedicated to fostering sustainable food systems among its Member States.



The Director General of IOFS Meets with Deputy Prime Minister and Minister of Foreign Affairs of Kazakhstan

On 9 September 2024, H.E. Berik Aryn, Director General of the Islamic Organization for Food Security (IOFS), was received by H.E. Murat Nurtleu, Deputy Prime Minister and Minister of Foreign Affairs of Kazakhstan, in Astana. During the meeting, Ambassador Aryn emphasized Kazakhstan's vital role in ensuring food security within the Islamic world and expressed gratitude for the government's continued support of IOFS initiatives. They discussed enhancing cooperation between IOFS and Kazakhstan, focusing on key initiatives to address food security challenges in OIC Member States. Amb. Both parties reaffirmed their commitment to fostering sustainable agricultural development and ensuring long-term food security across the Islamic world.



Ambassador Khusrav Noziri Appointed Assistant Director General of IOFS

The Islamic Organization for Food Security is pleased to announce the appointment of Ambassador Khusrav Noziri as the new Assistant Director General, following a unanimous decision by the IOFS Executive Board during its 3rd Extraordinary Meeting on 27 August 2024. Amb. Khusrav Noziri, a distinguished diplomat from Tajikistan, graduated from the Faculty of Oriental Languages at Tajik State University in 1991. He is fluent in Persian, Russian, English, and Arabic and holds the diplomatic rank of Envoy Extraordinary and Plenipotentiary of category II. Mr. Noziri's career includes serving as the Ambassador of Tajikistan to Egypt, Ethiopia, Algeria, South Africa and Morocco, as well as Permanent Representative of Tajikistan to the League of Arab States from 2014 to 2019, First Deputy Minister of Foreign Affairs of Tajikistan from 2019 to 2021, and as Secretary General of the Economic Cooperation Organization (ECO) from 2021 until August 2024. In his new role, Amb. Noziri expressed gratitude for the trust placed in him and emphasized his commitment to advancing sustainable development and food security, aiming to make a meaningful impact in collaboration with Member States and partners.



Strengthening Benin's Agricultural Resilience through Organic Fertilizer Production

From 9-12 September 2024, in response to the pressing need for sustainable farming solutions in Benin, the Islamic Organization for Food Security is collaborating in the "Increase of the Capacities of Benin in the Production of Organic Fertilizers." This initiative directly addresses the challenges faced by local farmers, particularly the degradation of soil and the high cost of chemical fertilizers, which have limited productivity and harmed the environment. The program focuses on empowering

farmers with the skills to convert agricultural waste into organo-mineral fertilizers, providing an affordable and eco-friendly alternative to chemical inputs.

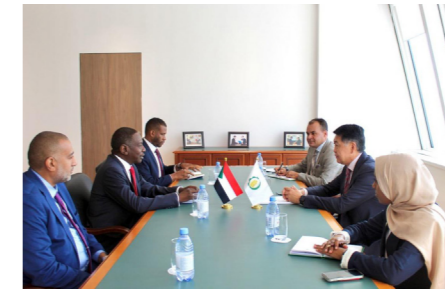


Benin Farmers Gain Expertise in Sustainable Organic Fertilizer Production

On 11 September 2024, a practical training session conducted at the Songhai Center in Porto-Novo, Benin, brought together over 50 farmers and agricultural professionals to learn essential techniques for producing enriched organic fertilizers. This training introduced participants to various composting methods, including aerobic composting using organic waste materials such as animal manure, crop residues, and food processing byproducts. Detailed guidance was provided on compost pile construction, emphasizing the use of diluted nutrient solutions like rabbit urine, which is rich in microorganisms and nitrogen, to speed up decomposition.



Ambassador Berik Aryn Meets with Sudanese Ambassador to Discuss Food Security Initiatives



On 12 September 2024, H.E. Ambassador Berik Aryn, Director-General of the Islamic Organization for Food Security (IOFS), welcomed H.E. Ambassador El-Ghazali Eltigani Sirrag, Ambassador of the Republic of Sudan to the Russian Federation, at the IOFS Headquarters in Astana. During their meeting, Ambassador Aryn emphasized Sudan's strategic importance within the OIC as a potential "Food Basket" for the region. He expressed hope for stabilization in Sudan amid ongoing humanitarian crises, aligning with IOFS's mission to promote sustainable food security. Ambassador Sirrag, in his response, provided an overview of Sudan's significant challenges in agriculture and food security due to recent conflicts and economic disruptions, which have severely impacted food production. He formally

requested IOFS support for humanitarian aid programs aimed at addressing food shortages and facilitating agricultural recovery.

IOFS and Asyl-Tulik Strengthen Ties to Drive Innovation in Livestock Breeding and Food Security

On 13 September 2024, the Director General of the Islamic Organization for Food Security (IOFS), H.E. Amb. Berik Aryn, led a delegation to the Asyl-Tulik Republic Center for Animal Selection. The visit was hosted by Mr. Bolat Seisenov, Head of Asyl-Tulik, who provided an overview of their pioneering work in livestock breeding and advanced insemination techniques for large and small ruminants. Discussions explored potential collaboration, particularly in the context of the IOFS Gene Banks project and enhancing Kazakhstan's animal protein supply chain to the Gulf Cooperation Council (GCC). H.E. Aryn emphasized the significance of aligning efforts to bolster food security, with both parties recognizing the growing importance of livestock breeding in sustainable agriculture.





IOFS and Iraq Strengthen Cooperation on Food Security and Agricultural Development

On 9 September 2024, His Excellency Ambassador Berik Aryn, Director General of the Islamic Organization for Food Security (IOFS), met with Dr. Jaber Al-Tamimi, Chargé d’Affaires of the Iraqi Embassy in Kazakhstan, to discuss ongoing collaboration in humanitarian efforts, agricultural development, and climate change mitigation. The meeting addressed the severe impact of climate change on Iraq’s agriculture, particularly water scarcity and drought, with IOFS committing to provide tailored capacity-building programs to enhance sustainable practices.



Director General of IOFS Meets Advisor to the President of the Republic of Kazakhstan on Science and Innovation

On 24 September 2024, the Director General of IOFS, H.E. Ambassador Berik Aryn, held a productive meeting with Dr. Zakarya Kunsulu Daltonovna, Advisor to the President of the Republic of Kazakhstan on Science and Innovation.




The meeting focused on enhancing collaboration between IOFS and Kazakhstan in areas of mutual interest, particularly in science, innovation, and food security. During the discussions, both sides emphasized the importance of strengthening bilateral cooperation to advance food security initiatives within the region. A key point of discussion was the development of the IOFS Gene Bank, a critical project aimed at preserving and ensuring the accessibility of agricultural genetic resources across the Organization of Islamic Cooperation Member States


Director General of IOFS Participates at New York Science Summit during UNGA79




On 24 September 2024, the Director General of the Islamic Organization for Food Security, H.E. Amb. Berik Aryn participated in the Science Summit during the 79th session of the UN General Assembly in New York, focusing on “Collaborative Solutions: Funding the UNCCD COP16 Flagship Initiative for Food Security and Sustainable Development.” The Director General delivered a video message highlighting the essential role of science and innovation in achieving food security, particularly in climate-vulnerable regions. He discussed the IOFS’s “Climate Impact/Resource Management” program, which aims to combat desertification, preserve ecosystems, and reduce agricultural emissions. The IOFS called for collective action from governments, the private sector, and philanthropic organizations to ensure food security becomes a tangible reality. The Director General also shared the panel with key stakeholders in food security, including H.E. Yasir Al-Rumayyan, Governor of the Public Investment Fund, H.E. Madalitso Wirima Kambauwa, Minister of Malawi, H.E. Monique Barbut, Special Envoy to President Macron of France and H.E. Cem Ozdemir Federal Minister of Food and Agriculture of Germany, among others.



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