

# MAGHREB PASA SYNTHESIS POLICY NOTE - MAGHREB POLICY ENGAGEMENT FOR RESILIENCE AND INCLUSIVE AGRIFOOD SYSTEMS

Maghreb: policy engagement for resilient  
and inclusive agrifood systems (P179965)

World Bank

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# Contents

<b>Acknowledgments</b> .....	<b>1</b>
<b>List of figures</b> .....	<b>3</b>
<b>Introduction</b> .....	<b>4</b>
<b>I. Enhancing the resilience of agri-food systems</b> .....	<b>7</b>
A. Climate change severely constraints water availability and thus agricultural supply and employment.....	7
B. Reforming agricultural insurance programs to strengthen agrifood systems.....	12
C. Water-efficient Irrigation combined with water policy is paramount for sustainable farming in Morocco (Note 3).....	15
<b>II. Increasing inclusiveness of agri-food value chains</b> .....	<b>17</b>
A. Food processing has large potential for job creation in Morocco .....	17
B. Financing agricultural cooperatives and service companies to enhance rural employment in Morocco (Note 4).....	18
C. Addressing data gaps on agrifood employment for realizing the job creation potential of the sector (Note 5) .....	19
<b>III. Realigning public incentives with sector resilience and inclusiveness objectives.</b> .....	<b>20</b>
A. Greening further the Green Generation Strategy in Morocco could increase its benefits and create additional jobs .....	21
B. Boosting conservation agriculture and organic farming across Morocco would generate economy-wide positive impacts. ....	22
C. Using the virtual water balance to balance trade, domestic production and water availability ..	24
<b>IV. Recommendations</b> .....	<b>28</b>
Axis 1: Upscaling the greening of agrifood systems .....	28
Axis 2: Enhancing resilience to climate change by reforming agricultural insurance programs .....	30
Axis 3: Fostering the creation of quality jobs in more efficient and inclusive value chains .....	31
Axis 4: Investing in better data and impact evaluation for better and cost-effective policies.....	32
Looking forward: an analytical agenda .....	33
<b>References</b> .....	<b>36</b>

## List of figures

Figure 1 - Structure of the PASA and intermediary deliverables (authors).....	6
Figure 2 - Anomaly in average annual temperatures.....	7
Figure 3 - Increase in drought frequency.....	8
Figure 4 - Change in area cultivated since 2000.....	8
Figure 5 - Soft wheat production in Morocco 1981-2023 in million tons (left figure) and 5-year moving average (right).....	8
Figure 6 - Change in land suitability for wheat production in Morocco (% change between 1950-2000 average and 2050 under RCP 8.5 scenario) .....	9
Figure 7 - Virtual water balance of Morocco's agrifood systems.....	25
Figure 8 - Water Trade Balances by Quantity (A- Left) and Value (B- Right) of Agricultural products .....	25
Figure 9 - Comparative Evolution of imports and exports of virtual water in Tunisia (billion m <sup>3</sup> /year) ....	26
Figure 10 - Recommendations axes .....	28

## Introduction

**The paramount objective of the global agrifood system is to secure food and nutrition for all, while ensuring a sustainable of natural resources and the provision of quality jobs.** It grapples with formidable challenges: while the SDG2 of "Zero Hunger" by 2030 is not on track, with worldwide food and nutrition insecurity being at record levels since 2015, unsustainable practices are precipitating the degradation of soil and natural ecosystems, loss of biodiversity, ocean acidification, and the pollution of air and water (IPCC 2022; UNCCD 2022; FAO 2023; Sutton et al. 2024). The agrifood sector's contribution to global greenhouse gas (GHG) emissions is more substantial than previously recognized, averaging 31% of global GHG emissions (Crippa et al. 2021; Tubiello et al. 2022; Sutton et al. 2024). A significant contributor to these emissions is the one-third of the world's food production that is either lost or wasted. Moreover, climate change has already curtailed global agricultural productivity by 21% between 1960 and 2020 (Ortiz-Bobea et al., 2021). Despite the agricultural sector's annual production being valued at \$5 trillion in 2021, the concealed environmental costs are staggering, estimated at about US\$12 trillion annually (FAO, 2023). To address these issues, annual investments must surge by 18-fold, reaching \$260 billion (Sutton et al. 2024).

**In the Maghreb region, agrifood systems are beset by similar yet magnified challenges, notably climate change and water scarcity, which severely threaten agricultural viability and economic prosperity.** The region, already amongst the most arid in the world, is projected to become even more parched. By 2050, droughts are expected to intensify, with their frequency rising by 20 to 60 percent, subject to regional and seasonal fluctuations (IPCC 2022). Agriculture remains the predominant consumer of water, especially in the absence of rationing. Historical trends indicate that, when irrigated agriculture needs are fully met, agriculture could account for approximately 88 percent, 76 percent, and 64 percent of water withdrawals in Morocco, Tunisia, and Algeria, respectively. Despite this, the region's agriculture areas are largely rainfed, rendering it highly susceptible to climate variability. The current agrifood systems focused on primary agricultural production, coupled with low diversification, leaves it vulnerable to both market and climatic disruptions.

**Yet, the Maghreb's agrifood sector has the potential to drive inclusive growth and create employment while addressing climate and sustainability issues.** It contributes between 10 to 15 percent to the Maghreb's GDP, which could rise to around 20 percent when considering the full agri-food value chains. The sector has the potential to enhance economic diversification and inclusion, reduce the gender gap, create post-pandemic jobs, and tackle climate change. Transforming the agri-food system to target both domestic and export markets with a sustainability focus could spur additional growth and employment, especially for youth and women.

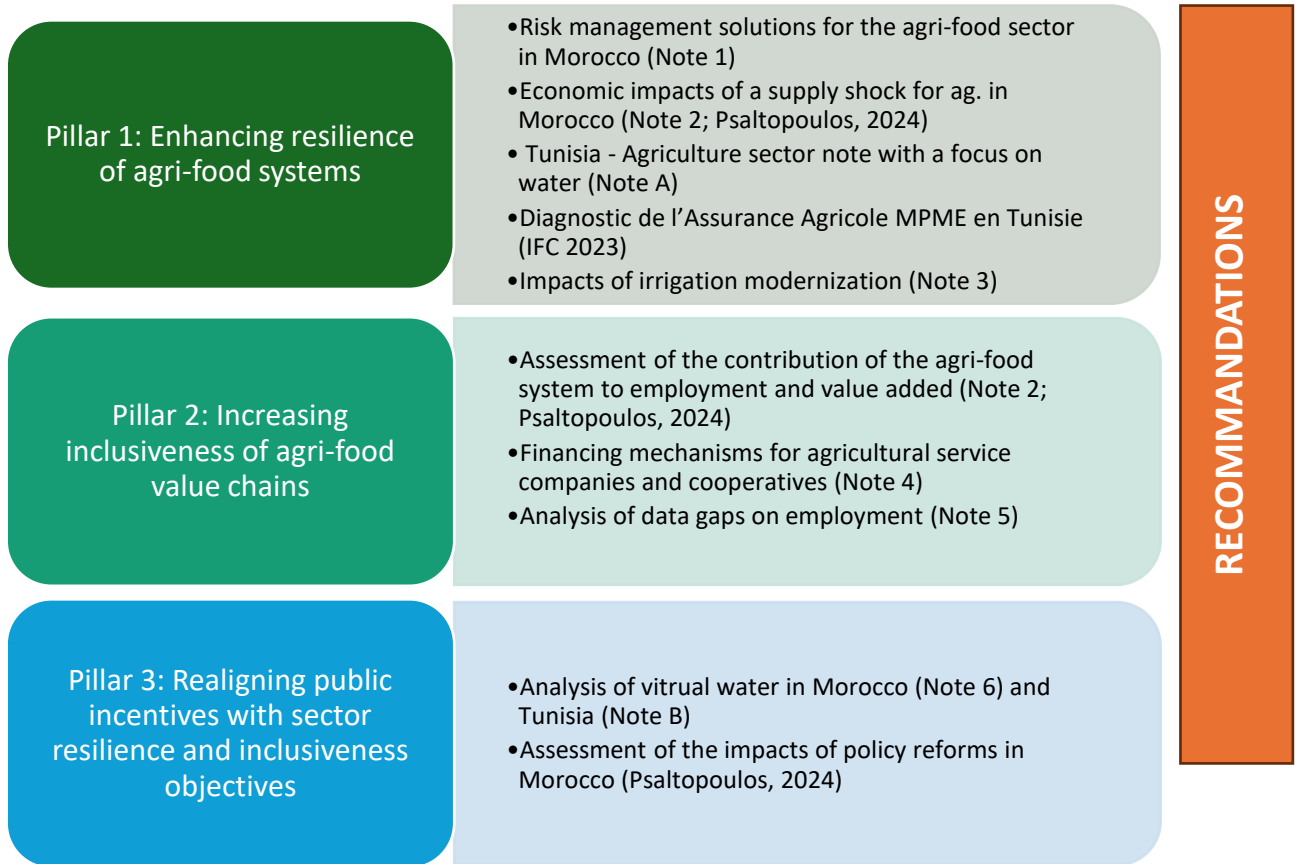
**In particular, in Morocco, the agrifood sector plays a crucial role in national and rural employment, food security, poverty reduction, and territorial development.** In 2022, it accounted for 16 percent of GDP, with primary agriculture making up 11 percent and contributing 13 percent to total export value, despite challenging climate conditions. In 2023, agriculture constituted 67 percent of rural employment and 36 percent of total employment, with 30 percent in primary production and 6 percent in agri-processing. The sector is also a significant employer of women, providing over half of female employment. Morocco's agricultural sector is vital and has strong potential for transformation to support greater economic growth, diversification and job creation, especially in food processing and manufacturing.

**An urgent, integrated, and effective policy agenda is required to support the transformation of Maghreb’s agrifood systems to produce more and better, with fewer natural resources and less waste, in a drier climate.** Tackling climate change and job creation is increasingly prioritized by policy makers in the region. For instance, the Green Generation Strategy (GGS) 2020-2030, launched by His Majesty King Mohamed VI in February 2020 in Morocco, represents a significant shift from a production-centered to a people-centered approach, timely for addressing multiple crises. The GGS provides a clear pathway for job creation and increasing economic opportunities in Morocco's disadvantaged rural areas, and aims to accelerate the transition to a more climate-resilient agriculture initiated by the *Plan Maroc Vert*.

**This note synthesizes the key findings of a series of analytical products developed over 2023-2024 to inform government decisions in Morocco and Tunisia towards more resilient and inclusive agri-food systems.** The work achieved builds on the previous Support Policy Dialogue in the Agri-Food Sector in the Maghreb Countries (P175347). In Morocco, it had shown that the *Plan Maroc Vert* had yielded impressive agricultural output and productivity increases and helped reduce climate vulnerability. However, it did not deliver equally well on employment in the sector, which now constitutes a key focus of the GGS. In Tunisia, the analysis had revealed the distortive effects of policy incentives, with 80 percent of subsidies for staple products being directed to cereal consumption, and inefficiencies in delivering public support. In addition, Country Climate and Development Reports (CCDR) in Morocco (World Bank 2022a) and Tunisia (World Bank 2023a) have explored the risks and opportunities between development goals and climate change. Tackling water scarcity and droughts, notably through the water-agriculture nexus, has emerged as a key priority.

**The work achieved was organized along three pillars, leading to integrated and prioritized recommendations (Figure 1).** Pillar 1 focuses on enhancing the resilience of the agri-food system, rethinking the strategy and tools for managing water scarcity, the drought risks and buffering their impacts. Pillar 2 sheds a new light on how to increase the inclusiveness of agri-food value chains by better analyzing and understanding how they impact jobs. Pillar 3 aims to guide public financing decisions by exploring the impacts of specific policies in terms of water use, production, and employment. After detailing the key results obtained for each pillar, the note concludes with a set of actionable recommendations for policy makers.

Figure 1 - Structure of the PASA and intermediary deliverables (authors)



# I. Enhancing the resilience of agri-food systems

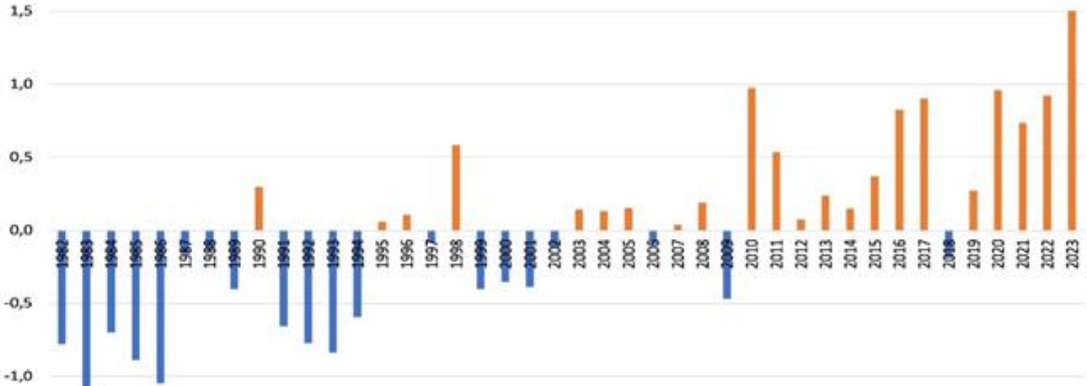
This chapter first summarizes the latest knowledge on the impact of climate change in Morocco and Tunisia, with a focus on the major constraints for the development of agricultural value chains, in particular water scarcity. It then outlines the key findings and lessons of the work conducted on agricultural insurance, which is a key tool to buffer the impacts of those shocks on rainfed agriculture in both countries. Finally, it presents the key messages from the work conducted in Morocco on how to optimize water use efficiency in irrigated systems.

## A. Climate change severely constraints water availability and thus agricultural supply and employment

- In Morocco

**Drought and heatwave frequency and intensity have increased over the last ten years in the already water-scarce context of Morocco** (Figures 2 and 3; Note 1). The country grapples with the effects of climate change on water resource availability and dam storage levels. Water availability per person per year has dropped in Morocco from 2,600 cubic meters (m<sup>3</sup>) in the 1960s to just 600 m<sup>3</sup> in 2020, closer to the absolute water scarcity threshold of 500 m<sup>3</sup> (World Bank 2022a). Over the past five years, Morocco suffered four droughts. The agricultural sector is inherently vulnerable to water shortages. While extreme events used to principally impact rainfed agriculture, recent droughts have reduced the irrigation potential of the Moroccan countryside. Dam reserves used for agriculture were halved in the last ten years, which has led to a 44% reduction in the area irrigated by large-scale irrigation (data MAPMDREF 2024).

Figure 2 - Anomaly in average annual temperatures



Source: CGMS-Maroc, Ed. INRA (2024) (Note 1)



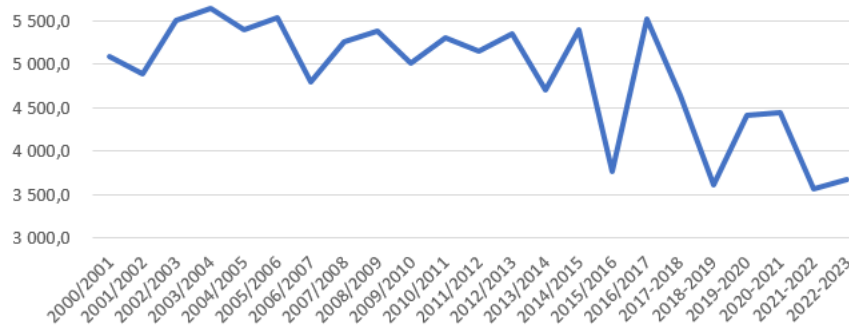
**Figure 3 - Increase in drought frequency**



Source: CGMS-Maroc, Ed. INRA (2024)

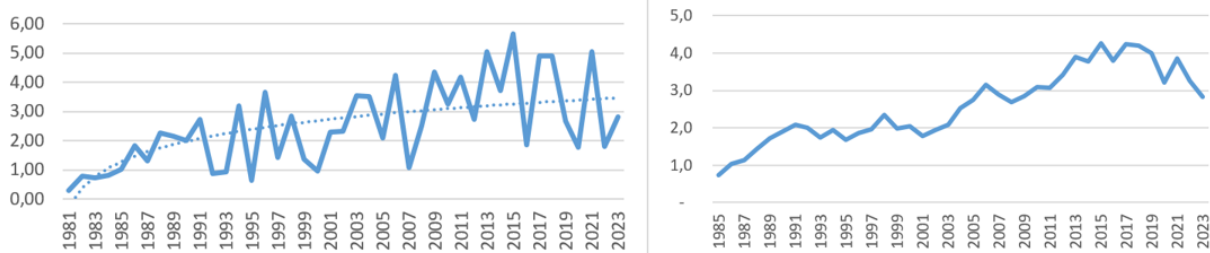
**Water scarcity severely constraints agricultural production, with both yields and farmed area being on a declining trend (Note 1).** Average cereal yield in Morocco decreased by about 40% between the successive periods 2001–2016 and 2016–2023, with the North of the country being less affected than the South. As a result of these climatic signals, Moroccan farmers have reduced their cereal cultivation by 38% over ten years (from 4.0 million hectares in 2016 to 2.5 million hectares in 2023–2024), leading to a 20% loss of Morocco’s cultivated area (Figure 4). Cereals, which account for the bulk of the rainfed area, are contributing less and less to Morocco’s agricultural output, necessitating an increase in feed grain imports. After thirty years of strong production increase, wheat output peaked around 2017 and now displays a declining trend (Figure 5). While volatility has also been high, production being highly dependent on rainfall, this variability is on the rise. Wheat production has ranged from 2 to 10 million tons in recent years, covering 30 to 75% of the national needs. Livestock production has also suffered a decline over the last five years. Morocco, which was self-sufficient in sheep and beef products a few years ago, has now become an importer of these animals, notably to meet the needs of the Aid Al ADHA period.

**Figure 4 - Change in area cultivated since 2000**



Source: authors (Note 1) based on MAPMDREF data (2024)

**Figure 5 - Soft wheat production in Morocco 1981-2023 in million tons (left figure) and 5-year moving average (right)**



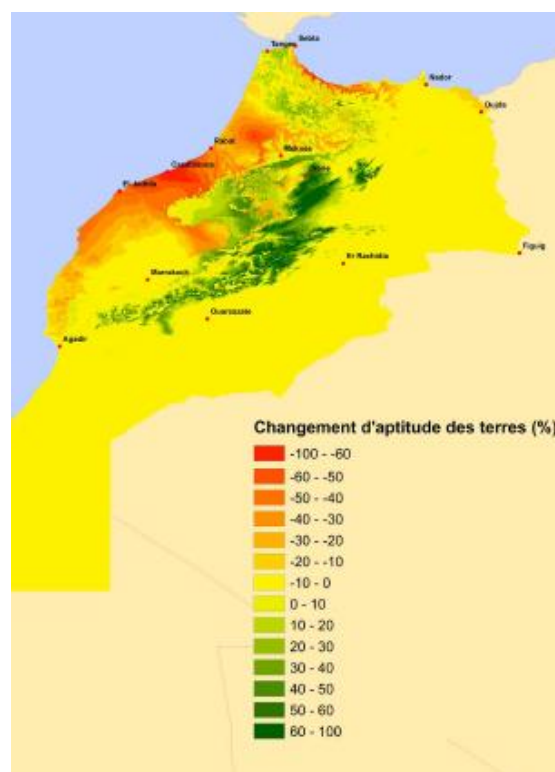
Source: authors (Note 1) based on MAPMDREF data (2024)

**Agricultural production shocks have significant macroeconomic impacts on Morocco, particularly on employment (-4%) and land income (-26%)** (Psaltopoulos, 2024). Morocco is forecast to grow at 2.4 percent in 2024, down from 2.8 percent in 2023. This is reflective of a sharp deceleration in the agricultural sector which would contract by almost 3 percent in 2024 as unusually dry and warm conditions compromise key crops (World Bank 2024). The agriculture, forestry, and fishing sector lost 202,000 jobs between 2022 and 2023, mostly due to drought and other factors affecting rural labor demand (Haut Commissariat au Plan, 2023). This represents about 4.6% of rural jobs (4.17 million in 2023). The reduction in average annual rainfall levels between 2018 and 2021-2023 was estimated at 35.6%, leading to a supply shock of -54.38% for rainfed crops (durum wheat; soft wheat; barley; legumes; forage; and green beans) (Psaltopoulos, 2024). A mixed exogenous/endogenous variable version of the Leontief model adjusted to a SAM (Miller and Blair, 2022) enabled to assess the economic impacts of this supply shock, while relying on the detailed agricultural SAM previously developed for Morocco by the World Bank. The analysis finds that rainfall shortage is estimated to lead to around 425,000 job losses (-4.0% of baseline employment in 2018) and a -26% decrease in land income. In addition to these effects, droughts also have significant fiscal and balance of payment impacts due to the emergency support that is provided to farmers in exceptionally dry years and larger volumes of grain imports. As an example, the emergency plan to address the 2022 drought costed USD 1 billion.

**Droughts and water scarcity disproportionately affect poor farmers.** 79 percent of Morocco's poor live in rural areas and most of them depend on rainfed agriculture as a source of food and income. In this context, the increasing incidence, severity, and duration of droughts has become a key driver of vulnerability for the rural population. Up to 1.9 million Moroccans (about 5.4 percent of the total population) who currently farm in rainfed areas could watch drought affect crop yields and decide to move to urban areas by 2050 (World Bank 2022a).

**Climate projections indicate a strengthening of the ongoing water scarcity, which will drastically change Morocco's ability to produce cereals.** Under RCP 8.5 climate scenarios, Morocco will undergo a temperature rise of 1.3°C (+/- 0.2°C) by 2050 and 2.3°C (+/- 0.9°C) by 2090 compared with the 2010s. Rainfall is expected to decrease by 11% (+/- 0.5%) by 2050 and by 16% (+/- 1.3%) by 2090, with a switch in rain patterns (staggered winter rains and increasing rain amplitude) (Balaghi, 2017). Vegetative cycles will therefore be greatly disrupted, with vegetative growth periods reduced by 30 days by 2050 and 90 days by 2090 compared to 2010. The wheat-growing potential in Morocco in 2050 under the RCP 8.5 scenario would be radically modified, with drastic

*Figure 6 - Change in land suitability for wheat production in Morocco (% change between 1950-2000 average and 2050 under RCP 8.5 scenario)*



Source: Balaghi et al. (2016)

narrowing of the highly productive northern areas (Balaghi et al. 2016; Figure 6). In the high mountain regions of Atlas and Rif, the increase in average and minimum temperatures will improve the current conditions for wheat cropping. However, the high relief and poor soils of these areas are not conducive to high quality cereal production and these land gains will not compensate the northern losses of the best wheat-cropping areas.

**Over the past fifteen years, the Government of Morocco has been very active to foster the adaptation of the country's agrifood system to climate change and water scarcity.** The Plan Maroc Vert (2008-2018) deeply promoted adaptation measures such as the dissemination of climate-resilient agricultural practices. As drought has become a structural phenomenon in Morocco, its management has been internalized in agricultural and rural development programs. For instance, the Morocco's National Drought Plan (NDP) is highly structured in terms of climate risk analysis and action projects. The National Irrigation Water Saving Program (PNEEI), implemented over 15 years, anticipated the reduction in water availability for irrigation and the need to do more with less, notably through localized irrigation and improved water governance. Yet the speed and severity of climate change calls for upscaling the level of ambition and effective implementation of greener agricultural policies.

**Indeed, climate projections call for urgent and massive adaptation measures, adjustment of national production targets and reforms of existing risk management instruments.** The Morocco "Program Contract for the development of cereals and leguminous over 2021-2030" aims to improve the rate of use of certified seeds up to reach 40% compared to 19% in 2020 for cereals and 15% compared to 2% in 2020 for legumes, a balance of cereal/legume crop rotation over an area of 5 million hectares and an increase in production of cereals to 9.5 million Mt and legumes to 0.65 million Mt. It also provides for a doubling of the area insured against climatic hazards up to 2.2 million hectares. Current production levels and rainfall and temperature projections call for a reassessment of these targets which appear overly ambitious in the context of accelerating climate change.

- In Tunisia

**Tunisia's agrifood systems are increasingly challenged by hydrometeorological vulnerabilities, including recurrent droughts that impede national growth.** Identified by the IPCC as a Mediterranean hotspot, the country grapples with water scarcity due to diminishing rainfall, coupled with rising water demand from higher temperatures, and escalating extreme weather events (droughts, floods, heatwaves, wildfires). Losses due to catastrophic climatic hazards over 2014-2022 are estimated at about USD 112 million (World Bank 2023a). Currently in its seventh consecutive year of subpar rainfall, Tunisia saw its 2023 hard wheat yield plummet to just one-third of the previous year's harvest. The Grain Board (Office des Céréales - OC) struggled to augment imports, resulting in an 18% drop in hard wheat market supply for the first half of 2023, which in turn fueled a 14% surge in food price inflation compared to 2020-21 (World Bank 2023b). With 2024 marking another dry year, dam water levels have dwindled to a mere 33% by the end of spring, threatening irrigated farming. Echoing trends in Morocco, Tunisian farmers have scaled back wheat cultivation areas from 1.5 million hectares in 2011 to 1.1 million in 2021 (World Bank 2022a), reflecting a broader agricultural sector contraction of 11.2% from 2019 to 2023 (World Bank 2023a). Another consequence of climate change is the increase in forest fires: between 2011 and 2018, the country suffered more than 2,550 fires that ravaged nearly 34,000 hectares of forests (note A).

**In Tunisia, climate change is anticipated to exacerbate water shortages and degrade arable land through rising sea levels and salinization.** According to the now-prevalent RCP 8.5 climate scenario, coastal groundwater resources could diminish by approximately 75% by 2050. Sea levels, expected to rise 30 to 50 cm by mid-century, may salinize up to half of the coastal aquifers' current resources and indirectly reduce the potential of irrigable land by about 38,000 hectares—almost 10% of today's irrigated areas (Republic of Tunisia 2015; Republic of Tunisia 2021). If current trends persist, these factors, coupled with soaring demand, could precipitate a water crisis in Tunisia with far-reaching impacts across multiple sectors, including energy, sanitation, and territorial conflict (ONAGRI 2020).

**In the absence of substantial adaptation measures, Tunisia's agricultural sector is poised for continued contraction, with significant employment and livelihood implications.** By 2030, climate change may reduce the sector's value added by 15% and its GDP contribution by 5-10%, equating to a loss of USD 3.7-4.7 billion (Republic of Tunisia, 2021). Yield declines are anticipated for key crops under the RCP 8.5 scenario: olives (69%), soft wheat (35%), and barley (41%) by 2050 (World Bank 2023a). Shifts in bioclimatic zones could further reduce arable land. Oases, reliant on water resources, face production declines, threatening their unique heritage (AFD-OSS-UGPO-CC 2022). The livestock industry may see pastures halved, necessitating increased feed imports or animal-sourced livestock product imports. Forestry ecosystem losses could cost USD 11.5 million annually by 2030. Conversely, fisheries might see a 50,000-ton increase in potential production, a 56% rise from the 1990-2010 average. However, this masks disparities such as a projected 20% loss of fishing areas in the Kerkennah archipelago under RCP 4.5. Climate change is expected to eliminate at least 30% of agricultural jobs by 2050, with agricultural income potentially falling by 30 to 50% (Ministry of Environment 2021; World Bank 2023a).

**Therefore, Tunisia has developed a wide array of programs and policies to promote climate change mitigation and adaptation.** The country has updated in 2021 its Nationally Determined Contribution with the goal to reach carbon neutrality by 2050. It aims to triple the contribution of the agricultural sector (AFOLU) to the country's greenhouse gas emission mitigation ambitions. In addition, Tunisia has developed: (i) a National Low Carbon and Climate Change Resilience Strategy (SNBC-SNRCC, Republic of Tunisia 2022) which aims for a carbon-neutral economy and resilient development by 2050; (ii) a National Plan for Adaptation to the Effects of Climate Change, with encompasses both food security and land use planning; (iii) a Disaster Risk Reduction Strategy 2021-2030 and its action plan; (iv) a national plan to combat desertification; (v) a National Drought Plan; (vi) a Water 2050" Strategy; (vii) and a Biodiversity Strategy and Action Plan. Several strategies have also been developed for the agriculture sector (forestry, agricultural land management and conservation, organic agriculture, etc.). As an example, a substantial modernization program for Tunisia's National Meteorological and Hydrological Service (NMHS) has been designed.

**Public investments within the agricultural sector are heavily concentrated on water management.** Enhancing irrigation efficiency through the rehabilitation and modernization of outdated irrigation systems offers significant potential for diminishing water demand. The country has thus made substantial investments in surface water mobilization, accounting for 35 to 56% of total agricultural sector investments since 1990 as per development plans. In recent years, most of these public funds have been channeled towards rehabilitating and updating the infrastructure of existing irrigation schemes. In 2021, irrigated farmland represented about 441 000 ha (with 56% of public schemes), about 4.8% of total farmed area in Tunisia (MARHP 2023).

**However, adapting the Tunisian agricultural sector to climate change and safeguarding its production and employment contributions necessitates a policy realignment and shift of incentives.** Financing adaptation would require mobilizing 3-4% of the national budget by 2050, exceeding USD 1 billion annually (Republic of Tunisia, 2021). Presently, most agricultural subsidies are misaligned with these goals. Implementing nature-based solutions, such as the conservation and restoration of forests, watersheds, wetlands, and oases, could enhance groundwater reserves and complement existing water investments (World Bank 2023a). To foster resilient, rainfed agriculture, scaling up research, training, and specific public incentives for climate-smart practices like conservation agriculture or agroforestry is essential. Moreover, while plans for early warning systems are ambitious, their actualization is imperative, potentially curtailing annual disaster losses by USD 1.4 million. This measure alone could reduce annual disaster losses by USD 1.4 million (Suez Environnement et al. 2021), with a high cost-benefit: every US\$1 invested in hydromet services and early warning systems has been estimated to result in at least US\$5.5 in socioeconomic benefits (World bank 2022c).

## B. Reforming agricultural insurance programs to strengthen agrifood systems

- In Morocco

**To mitigate the agricultural losses caused by climate change, the Moroccan Government has developed and implemented a robust suite of ex-post risk management strategies.** Ex-post aid is typically reserved for compensating catastrophic losses that threaten farm viability due to significant external events. Beyond the emergency support triggered by climatic anomalies escalating to catastrophic levels, these ex-post measures may also encompass financial aid. For example, Crédit Agricole du Maroc has facilitated the restructuring of debts for farmers struggling to repay loans and interest and has encouraged the transition to alternative crops in areas severely impacted by drought. Additionally, substantial public support programs for livestock production (approximately \$270 million in 2022 and \$210 million in 2023) have been established to fund initiatives such as feed subsidies to offset the reduced production of feed grains, straw, and fodder, the establishment of watering points for livestock, and the financing of agricultural inputs.

**While ex-post instruments are necessary safety nets, they must not crowd out ex ante risk management tools.** There is a well-established academic consensus regarding the counterproductive effects of ex-post aid, particularly when it becomes a core component of a firm's risk management strategy at the expense of employing any ex-ante measures. The concept of the Samaritan's dilemma (Bagnarosa et al., 2024) has been developed in economic theory to illustrate these unintended adverse outcomes. Consequently, ex-post aid should be strictly limited to random events of pre-established extreme intensity. It ought to serve as a catalyst for implementing short-term preventative actions and longer-term adaptation strategies, particularly as the frequency of extreme events escalates. In Morocco, there is potential for the agricultural climate risk management policy toolkit to progress towards a more proactive ex-ante risk anticipation model, which includes shifting risk to a third party via insurance.

**A core element of the ex-ante risk management toolbox is enhancing resilient agricultural practices.** Reforms of the insurance system for rainfed agriculture need to be combined with efforts to improve productivity despite shocks. In the Morocco context, this includes a transition towards conservation agriculture (see section III-b), soil health management and crop diversification.

**After employing several aid programs through agricultural disaster funds, Morocco launched an ambitious multi-risk climate crop insurance program in 2011.** It began as a public scheme to guarantee cereals against drought in a few provinces but has since evolved into a comprehensive public-private insurance scheme. The agricultural mutual MAMDA and the Moroccan government have formed a public-private partnership to manage Morocco's agricultural insurance program, which covers a wide range of climatic and crop risks. MAMDA (the Mutuelle Agricole Marocaine d'Assurance) provides multi-risk insurance coverage (*Multi-Risques Climatique*, MRC) for field crops, in three agricultural zones, 10 regions of Morocco, with five levels of insured capital (linked to grain yield potential, farm size and agro-climatic zone), and also manages, on behalf of the State, a multi-risk guarantee fund for fruit trees (*Multi-Risques Climatique Arboriculture*, MRA). For the first insurance product, an array of insurance amounts and subsidies are offered for the 15 possible zone/level combinations. Eligibility for claims payment is officially declared when the yield of insured crops falls below 60% of the average yield for the previous 10 years in a Rural Commune. Designing and operating this insurance system is highly complex. Only 17% of farmers are insured in Morocco (with the reduction in cereal area in recent years, this rate has risen to 40%). Insurance mainly covers large farms: while 40% of large farms (>50 ha) are insured, this is the case of only 24% of medium farms (10 to 50 ha) and less than 3% of small farmers (<10 ha).

**The Green Generation Strategy (GGS) focuses on improving the efficiency of agricultural investments and policies, including expanding agricultural insurance to increase its use among small producers.** By 2030, the GGS plans to extend agricultural insurance against climatic risks from the current 1 million hectares to cover 2.5 million hectares. However, this ambitious goal is hampered by climate change and rising fixed and variable production costs. A reform was launched for the 2024-2025 campaign to modernize the current MRC contract and provide simplified climatic coverage for areas that have become commercially uninsurable.

**The insurance system context has changed considerably over the last three years, due to increasingly intense and frequent drought and heat waves and a sharp rise in production costs linked to the international context.** The pure risk premium for the Moroccan cereal farm has risen significantly, forcing an annual renegotiation of the agreement between the agricultural insurer MAMDA and MAPMDREF (Ministère de l'Agriculture, de la Pêche Maritime, du Développement Rural et des Eaux et Forêts)- with a downward review of insured capital levels and an upward review of premium rates. These factors have reduced the program's financial viability, with annual increases in premium rates and less insured capital. Costs are excessive for an insurance contract and highly inefficient as a system for granting public subsidies since there are high transaction costs. A major 2007/2008 survey of 19 subsidized national multi-risk crop insurance schemes worldwide (Mahul and Stutley 2010) revealed an average premium rate of 6.7%. In Morocco, average annual premium rates range between 35% and 54% (from 2011/12 to 2021/22). For the 2023/2024 crop year, the system operates with an overall average premium rate ranging between 51% and 79%.

**The current inefficiencies of the existing agricultural insurance program in a rapidly evolving climate context call for its gradual evolution.** For sometimes different (and potentially contradictory reasons), the program's stakeholders (MAPMDREF, MAMDA, farmers, insurers, reinsurers) converge on the necessity to reform the program to ensure its sustainability and the efficient use of public funding. However, the important supporting role of the program for small-scale farmers, the current insurer's

interest in continuing to manage the program and the technical challenges of making sudden changes all call for gradual changes with different time horizons.

- In Tunisia

**Extreme weather events pose a significant financial burden on the Tunisian government and its agricultural sector.** Studies show considerable variation in cost estimates, but the consensus underscores the urgent need to enhance preventative (adaptation) strategies and post-event risk management. On average, floods are estimated to lead to an annual loss of USD 40 million. Between 2011 and 2018, the combined impact of floods, droughts, and fires amounted to USD 541.3 million in losses (World Bank 2022c). The Tunisian Ministry of Agriculture reports that, from 2014 to 2022, extreme climate events have cost the agricultural sector approximately USD 112 million, with the government absorbing 40% of these costs (World Bank 2023a). IFC (2023) pegged the cost of agricultural losses in Tunisia at USD 400 million over the preceding decade.

**The increasing frequency and severity of natural disasters have prompted the creation of various public mechanisms to manage catastrophic risks and provide financial relief to affected farmers.** However, significant financial shortfalls persist. The National Guarantee Fund (FNG) offers guarantees for micro and small loans (including those for agricultural purposes), while SOTUGAR focuses on larger loans (>100,000 TND). From 2008, the State exempted all insurance companies involved in agricultural risks from the single non-life insurance tax (12%) and offered subsidies decreasing over time for cereal farming insurance premiums solely linked to bank credit from 2007 to 2015. In 2017, the Government introduced a Compensation Fund for Agricultural Damage (FIDAC) due to natural disasters covering damage not covered by conventional insurance (droughts, floods, frost, snow, strong winds) (IFC 2023). The activities targeted are irrigated and rainfed crops, livestock, agricultural production and fishing (note A). FIDAC is financed by an annual public contribution (of about 30 million TND), a 1% levy on income from the agricultural sector (membership of FIDAC is compulsory and automatic), and a contribution for farmers or fishermen of 2.5% of the cost of production or the estimated value of production, according to their choice. However, in addition to compensation for agricultural disasters (catastrophic risks), farmers should have the possibility of using private insurances to cover smaller losses in yield or turnover (note A).

**The agricultural insurance sector in Tunisia is in its infancy,** with a 2017 turnover of TND 6.4 million (USD 2.6 million), just 0.31% of the total insurance premiums for that year (note A). By 2021, this figure had only marginally improved to 0.42% (World Bank 2023a), with a scant 8% of farms insured (IFC 2023). The market is characterized by significant coverage gaps, especially for risks like drought and excessive rainfall, and existing commercial products are predominantly geared towards insuring the values of farm loans. This is particularly problematic given that a mere 7% of Tunisian farmers have access to bank loans, which are typically reserved for larger farms. Despite this, there is a clear demand for insurance: a survey by the IFC (2023) of 687 farmers found that about half were interested in index-based agricultural insurance, with a particular focus on drought risk.

**The potential for index-based agricultural insurance in Tunisia is clear, with technical feasibility and the possibility of commercial viability, but bottlenecks to address.** Such products could insure against yield losses or fluctuations in annual farm turnover and be based on yield loss or climatic indices. IFC's (2023) simulations for crops such as dates, wheat, and olives have demonstrated the technical feasibility of such insurances in Tunisia, even in the absence of subsidies. However, the development of these products is

hampered by several challenges, including a lack of data for accurate risk assessment and pricing, farmers' limited understanding of risk management tools, and low access to credit, which is often linked to insurance. The IFC survey also highlighted a general lack of confidence and knowledge among farmers regarding insurance, indicating a need for targeted financial literacy and communication campaigns to address these issues.

**To bolster agricultural risk management in Tunisia, a structured, multi-layered strategy is recommended.** The current low insurance penetration and stagnant growth of the local insurance sector necessitate initiatives that expand financial inclusion and establish comprehensive risk coverage, both catastrophic and non-catastrophic. Such measures are critical for nurturing a private insurance market that enhances financial resilience (World Bank 2023a). Collaborative efforts among stakeholders are key to developing and encouraging the adoption of these insurance products by Tunisian farmers (IFC 2023). Implementing a layered disaster risk financing strategy would strengthen Tunisia's financial defenses against climate-related disasters (World Bank 2023a). A proposed tripartite agri-insurance framework, with the Compensation Fund for Agricultural Damage (FIDAC) as a foundational element, could incorporate a disaster fund like FIDAC, index-based insurance, and indemnity insurance that accounts for individual farm metrics such as yield, income, and costs. This comprehensive framework would ensure coverage that is extensive in value and tailored to the specific needs of farms of various sizes and crop types (IFC 2023).

### C. Water-efficient Irrigation combined with water policy is paramount for sustainable farming in Morocco (Note 3)

**In response to increasing water scarcity and interannual variability, Morocco has enhanced support for its irrigation subsector, advocating for greater efficiency—'more crop per drop.** The country's resilience model, historically dependent on dam-stored water during wet years and increased groundwater use since the 1970s to offset surface water deficits, is under review due to escalating scarcity and variability, particularly in the Moulouya, Oum Er-Rbia, Tensift, and Souss Massa basins. The Moroccan government's initiatives, particularly the National Program for Water Savings in Irrigation, aim to address these challenges by modernizing irrigation, improving water productivity, and upgrading delivery services, promoting advanced technologies like drip irrigation. Progressive quota systems are also being established to manage surface water use and adapt to variability. Yet, the adoption of modern irrigation technologies has not consistently led to reduced water consumption at the farm level, especially in private irrigation, on which there are no effective controls. This situation underscores the complexities of sustainable water resource management in the face of growing demand and environmental change, necessitating ongoing government intervention and oversight.

**Indeed, using modern irrigation equipment increased water productivity and reduced labor and input costs, yet it did not consistently lower water use.** This is because farmers tend to maximize resources, leading them to intensify or diversify to higher value crops when equipped with drip irrigation, potentially increasing water use and potentially overusing aquifers. This phenomenon is known as the Jevons paradox (or rebound effect) and is well-documented in resource economics. It leads to a core policy question: can support to water-efficient irrigation have counterproductive effects by accelerating the depletion of water resources?



**To assess the impacts of water-efficient irrigation, detailed case studies were conducted on two irrigation schemes that modernized their systems (Note 3):** the Tadla scheme (covering 33 farms totaling 865 ha) and the Ouled Gaid scheme (2,200 ha), located in the Haouz region. In both cases, irrigation was upgraded from surface to drip system, providing natural experiments to assess the impact of the technology upgrade<sup>1</sup>. Identical impact indicators were used to assess water consumption (evapotranspiration) and productivity (Biomass Water Productivity, i.e., crop biomass per cubic meter of water used). In Tadla, the impact assessment used remote sensing data from 2015 to 2021, with NASA's Landsat 8 (15-meter spatial resolution) supplemented with field data. This allowed to identify crops grown and water use, and to robustly estimate the impact of the transition to more water-efficient irrigation systems.

**While water productivity improved on both studied schemes, water consumption was reduced by 25% in Tadla between 2015 and 2021 but not in Haouz.** In Tadla, seasonal evapotranspiration (from January to May) declined by 25% between 2015 and 2021 while water productivity increased from 1.7 Kg/m<sup>3</sup> to 2 Kg/m<sup>3</sup> (+18%). Field surveys have shown that this increase in productivity stemmed from crop diversification (e.g., substituting wheat with alfalfa or sesame) and cropping intensity increase. In the Haouz scheme, the transition to drip irrigation led to neglectable water consumption decline (by -4%). Water productivity increased by +6.7%.

**The differences in water consumption and productivity between the two cases can be attributed to water quotas and crop diversification, reinforcing the call to pair infrastructure investments with policy reforms.** During the study period, contrary to Haouz, the Tadla scheme implemented water quotas, informing farmers of their allocated water amount at the campaign's outset, and providing regular updates on their consumption throughout the growing season. Additionally, farmers adjusted their agricultural practices in response to water scarcity. These observations underscore the importance of enacting water conservation policies alongside technological advancements to keep water withdrawals sustainable and manage yearly fluctuations. Moreover, these findings support the enhancement of long-term impact assessment methods for such technological changes, including the creation of observatories like those suggested in the RESWAG (Resilient and Sustainable Water in Agriculture) project.

**In addition to quotas, Morocco has a suite of water management strategies that could be enhanced, particularly in water pricing.** There are two main pricing instruments: the Domaine Public Hydraulique fee, which aligns with the user/pays and polluter/pays principles, incentivizing sustainable water use and accounting for water scarcity, especially for users outside of collective services who tap into overused water sources (like private irrigation). This fee is set at a minimal MAD 0.02 per cubic meter, and although all users are expected to pay, the cost of collection often surpasses the revenue, suggesting a need to reevaluate its pricing structure. The second instrument, the service provision fee or irrigation fee, is designed to recover the costs of operation, maintenance, and amortization for collective systems, not applicable to private irrigation. Governed by decree, which includes provisions for adjustment, this fee has remained unchanged for the past 12 years due to farmer protests over perceived declines in service quality. Both pricing tools are crucial for managing Morocco's water resources and offer opportunities for refinement to better promote water sustainability and efficient management.

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<sup>1</sup> The case studies were supported by the Quality Infrastructure Investment Trust Fund (Tadla scheme) and the Water GP-Bank Budget and Water Expertise Facility (Haouz scheme). The modernization of the Tadla scheme was achieved through the PROMER project in 2018.

#### Box 1. Dissemination and use of Pillar 1 findings in Morocco and Tunisia

In Morocco, the findings of the PASA were discussed and agreed with the MAPMDREF leadership. The reform proposals stemming from this pillar will be implemented in the new PforR under preparation (Transforming agrifood system in Morocco). The PASA has already provided substantive inputs into the Government's decisions regarding the current agricultural insurance policy, shaping a shift to a more comprehensive risk management framework. Policy notes and solutions have been discussed with the government counterparts, supporting them on a range of activities, both on a short-term horizon (e.g., evaluation of actuarial model utilized by the MAMDA, the provider with dominant position for agricultural insurance in Morocco) to long-term (developing a roadmap for a comprehensive risk management framework in agriculture). Two missions involving international experts were carried out in September and December 2023 to finetune the roadmap of the reform, including the split of the current insurance system into two new tools: (i) a Guarantee Program for commercially non-insurable areas; and (ii) modernized Private Insurance products for commercially insurable areas. Additionally, a Policy Tool was developed by the GAD (Government Actuarial Development for UK) to support decision-making.

In Tunisia, discussions with the Ministry of Agriculture, partly fueled by the findings of the PASA, led to agree upon an operational roadmap to enhance the resilience of the cereal sector to shocks and climate change. This roadmap includes three main components: (i) updating the Tunisia Bioclimatic Map, (ii) assessing Tunisia national cereal consumption, and (iii) cereal crop estimation through remote sensing tools. The three activities are being undertaken by the Ministry of Agriculture. In addition, on agri-insurance, a diagnostic work has been carried out between January and June 2023 by IFC. The surveys undertaken on 687 smallholder farmers in Tunisia allowed to: (i) model farmers' willingness to pay for index-based agri-insurance products by region/crop/climate risk, and (ii) design prototypes of index insurance products. An agri-insurance capacity-building workshop and a study results dissemination workshop were conducted in December 2023 for the private sector operators. Another dissemination workshop for the Ministry of Agriculture is planned in July 2024.

## II. Increasing inclusiveness of agri-food value chains.

**The agricultural job landscape in the Maghreb is changing rapidly, influenced by global trends, and exacerbated by climate change.** As urban areas grow and become wealthier, food systems evolve, becoming more complex and expanding both upstream and downstream. With an overall increase in income, the demand for protein, micro-nutrients, and processed food increases, leading to new job opportunities across the agrifood supply chain. This section distills findings from three studies on Morocco's agrifood job potential. The first assesses the sector's impact on employment and economic value; the second examines cooperative and agricultural service financing; and the third proposes solutions to the data deficit on agricultural employment and inclusiveness.

### A. Food processing has large potential for job creation in Morocco

**To assess the job creation potential of the agrifood system in Morocco, its contribution to economy-wide employment and value added was analyzed** (Psaltopoulos, 2024). Input Output (IO) analysis was utilized to estimate backward and forward linkages of agri-food sectors of Morocco (World Bank, 2019a; 2021) using 2014 and 2018 national IO tables and employment data published by OECD. This method allows to represent the interdependencies between different branches of a national economy and is typically used to understand how changes in one sector of the economy can affect others. *Backward* linkages are the relationships that agricultural producers have with input suppliers for agricultural

production, and thus affect agricultural productivity and competitiveness. *Forward* linkages are the connections between agricultural producers and the downstream sectors using their products (processors, wholesalers, retailers and consumers), thus determining the demand for agricultural products.

**Compared to other sectors, agriculture generates a high but declining number of direct jobs in Morocco, while food processing has low but increasing job creation.** Farm job losses, already discussed in Chapter 1, are confirmed by the IO analysis. Nevertheless, the increase of the food processing direct employment coefficient (+8.85%) is notable and could indicate the potential of the sector to generate jobs. Food processing also appears to create jobs in other sectors (i.e., high indirect jobs effect), which is not the case of primary agricultural production.

**Food processing is the sector with the highest output multiplier in Morocco.** Backward output linkages between agriculture, food processing and the rest of the economy in Morocco are moderate and high, respectively. In 2018, an increase of USD 1 million in agricultural output generated an additional economic stimulus of USD 0.371 million. The relevant figure for food processing is almost double (USD 0.761 million). Food processing is the sector with the highest output multiplier effects in Morocco (1<sup>st</sup>/28 sectors), while agriculture is 11<sup>th</sup>/28. There is a small decline in both multipliers since 2014.

**Agriculture and food processing have low integration with the rest of the economy in Morocco, as shown by low and marginally declining forward output multipliers.** This finding suggests that the linkages of both sectors to the rest of the economy could be improved, for instance through increased marketing and greater positioning of Moroccan agricultural products for domestic use. In the same line, value-addition in both agriculture and food processing in Morocco appear comparatively low. However, it is encouraging that since 2014 the value of the coefficient has increased for both agriculture (+2.49%) and food processing (+0.90%). Greater integration, as noted above will be critical in the future, as well as innovation for increased value addition in the Moroccan agri-food industry.

## B. Financing agricultural cooperatives and service companies to enhance rural employment in Morocco (Note 4)

**Fostering agricultural service companies and cooperatives would be an efficient way to foster the agrifood sector performance in Morocco and create quality jobs in rural areas.** Morocco currently has diverse financing options for entrepreneurship, but they don't directly target agricultural, para-agricultural and digital service businesses and cooperatives. However, cooperatives are critical components of the agriculture, artisan, and tourism sectors, and have high job-creation potential, including for women (Ibourk and El Aynaoui 2023, . The government has tried to improve access to financing, focusing on guarantees, enhancing financial support, bolstering the micro-credit sector, and promoting financial inclusion and income-generating activities. Despite this, the agricultural sector, especially service companies and cooperatives, gain little from current financing initiatives due to: (i) difficult access to financing due to complex procedures and documentation requirements; (ii) insufficient guarantees from service companies and cooperatives; (iii) financing limits below market needs; (iv) limited awareness of available financing options; and (v) poor coordination among programs.

**Increasing the financing of agricultural and para-agricultural service companies and cooperatives would require collaborative efforts from multiple private and public financiers.** International best practices

recommend financing agricultural service enterprises and cooperatives through a mix of public subsidies, commercial loans, and Public-Private-Producer Partnerships. There is a need to diversify financing sources and instruments for these enterprises and encourage collaboration among different stakeholders.

**Five financing instruments could be developed or strengthened in Morocco.** (1) The first is financing the establishment of businesses and cooperatives via local authorities and regional councils. Looking forward, MAPMDREF could sign specific regional agreements to devote a larger percentage of funding to agricultural businesses and cooperatives in rural areas. (2) Official support structures (FORSA 2nd Edition, INDH) could increase the participation share of agricultural and para-agricultural service companies/cooperatives in their current financing programs, by signing an inter-ministerial agreement to incorporate a more ambitious target in the current financing programs (FORSA 2nd Edition, Maroc PME, etc.). (3) Solidarity microcredit loan for rural areas could be developed. (4) Alternative support structures (such as Réseaux entreprendre, CEED Maroc, SOS Maroc (Bidaya), etc.) could be more directly supported. (5) Bank financing could be stepped up (ex, GCAM, "Al Moustatmir Al Qaraoui" program, "INTELAKA" program).

**Finally, another key action could be to establish a dedicated budget line within the MAPMDREF budget for agricultural service companies and cooperatives.** This would align with international best practices and the growing funding need. This instrument would give the Ministry flexibility to fill unmet gaps from other sources, and to specifically focus on agricultural entrepreneurship. It would allow to set selection criteria based on sector needs and prioritize as needed. A recognized financial institution or association could oversee management and operating under a state-endorsed agreement. Recipients could receive comprehensive training for their selected projects, participate in an incubator, and/or training from Ministry-approved groups.

### C. Addressing data gaps on agrifood employment for realizing the job creation potential of the sector (Note 5)

**The Green Generation Strategy (GGs) 2020-2030 offers a clear pathway to job creation and increasing economic opportunities in Morocco's relatively more disadvantaged rural areas.** It emphasizes fostering the growth of the middle class in rural areas, job creation for the youth on- and off-farm and building human capital and skills to facilitate higher productivity employment and labor mobility. In 2025, the Mid-Term Review of the GGS will offer opportunities to assess and increase the efficiency of the strategy at creating jobs. This review and its relevance will highly depend on the quality of available employment data.

**Important gaps currently exist in agrifood employment data in Morocco, hampering policy targeting and improve efficiency of public spending.** Note 5 assessed the coverage and quality of this core data, also considering the institutional issues in collecting and managing it. Findings indicate shortcomings in the methodology used by the Haut Commissariat au Plan (HCP) to collect household surveys. Yet these gaps are being addressed as part of a two-year restructuring effort so that the HCP meets international standards.

**HCP data collection could also be complemented by additional sources to cross-check information and remove possible biases or gaps in methods.** These include (i) using administrative data the government already has (such as Social Security records, employer tax returns, and other government sources); (ii) data collected as part of specific government programs (ex. Social Protection; GGS 2020-2030; National

Employment Strategy); (iii) implementing and expanding the National Agricultural Register database of farms and owners.

**In addition, the Ministry of Agriculture is developing a system at local level for monitoring agricultural employment that follows international best practices.** This initiative will harmonize data collection, analysis and management on agricultural sector employment, drawing inspiration from effective models observed internationally. Also, the GGS calls for establishing a centralized system at the Directorate of Strategy and Statistics that will collect data from agencies in charge of promoting employment and agricultural entrepreneurship. This system will allow the Ministry to have a comprehensive, real-time overview of agricultural sector employment to support decision-making and develop and implement appropriate policies. These actions could lead the Ministry of Agriculture to develop and implement a comprehensive action plan to create an “agricultural employment data observatory” which would be a permanent, inter-agency structure that could coordinate and consolidate agricultural employment data and use it for policymaking.

**Box 2. Main takeaways of the Pillar 2 findings in Morocco**

Work on this pillar has progressed more slowly than anticipated, as the newly established employment unit within MAPMDREF had to be established, staffed and ready to engage. Initial technical discussion took place in September 2023, and enabled scoping the technical assistance needs and priorities of the Moroccan counterparts. There are two levels of interest: (i) improving inter-agency collaboration on and sharing of national employment statistics (especially regarding the integration of food employment statistics with primary agricultural employment statistics); and (ii) measuring and evaluating the employment effects of domestic support programs in the agri-food sector.

Under this pillar, an analysis was carried out to respond to a demand from the Ministry of Agriculture to identify the policy options to create a favorable environment for the development of Cooperatives of services in the agricultural sector, especially for youth. The findings of the analysis were summarized in a short note disseminated to the main counterparts.

Agri-food employment has been identified as a key focus area for future cooperation. The needs span from technical assistance to investment to build capacity for data collection, management, and integration into the policy decision process, along the two tracks identified above.

### III. Realigning public incentives with sector resilience and inclusiveness objectives.

**The imperative transition of Maghreb's agrifood systems towards resilience and job creation demands a strategic overhaul at the national level.** This shift requires a realignment of policies to incentivize all stakeholders within the complex food value chains. This chapter compiles the outcomes of two sets of analyses assessing the impacts of current policies and potential alternatives. Sections A and B discuss the results of policy scenarios modeled using the Morocco Social Accounting Matrix (SAM). Section A examines the impact of the Green Generation Strategy (GGS) on economy-wide employment and value-added and considers the effects of further greening the strategy. Section B investigates the large-scale adoption of no-tillage and organic farming through two stylized scenarios. While the GGS has much broader objectives than jobs and value-addition, the analysis conservatively focuses on these outcomes. Section C adopts a different angle, evaluating the virtual water used, exported, and imported by Morocco and Tunisia, casting

new light on the delicate balance between national food production versus food trade in a water-scarce context.

#### A. Greening further the Green Generation Strategy in Morocco could increase its benefits and create additional jobs

**The 2021-2030 Green Generation Strategy (GGS) is a key component of Morocco's broader efforts to shift towards low-carbon and climate-resilient development while creating new jobs, revitalizing rural areas, and positioning Morocco as a green hub.** The average annual expenditure of the GGS is significant, representing around 8% of agriculture value added and 1.0% of total value added in Morocco (Psaltopoulos, 2024). The most dominant policy packages included in the GGS (by expenditure) are: FDA (Fonds de Developpement Agricole) (36.2%), Irrigation and Development of Agricultural Space (21.3%), followed by Innovation of Quality Control (9.4%), Solidarity Agriculture (9.1%) and Young Farmers Incentives (8.1%). These categories encompass a broad range of measures, which have been lumped together for the purpose of this analysis.

**The economic impacts of the ongoing 2021-2030 GGS were assessed and compared to those of a “greener” version of the strategy** (Psaltopoulos, 2024). The Baseline scenario represents the current Strategy, which allocates 40% of funds to green activities like drip irrigation subsidies, organic certification and rural development. The “Greener” scenario increases this allocation to 60% by reallocating 20% of funds to the greenest activities. The 2018 Social Accounting Matrix (SAM) Model for Morocco was used for this analysis. Policy flows in the 2021-2030 GGS were quantified based on information from the Ministry of Agriculture and converted to 2018 prices.

**The analysis finds that the GGS is expected to create significant job growth in Morocco.** On average, it could generate 186,300 new jobs over 2021-2030, a 1.7% increase from the baseline year employment (2018). This job creation estimate is considered as very conservative due to the model structure. As a comparison point, the Plan Vert Maroc is considered to have created between 250,000 and 300,000 full-time equivalent jobs over 2008-2018 (against of target of 1.5 million). Annually, the plan could increase the economy’s output by 20.2 billion MAD and raise household income by 9 billion MAD. Income from production factors would increase an average of 4.3 billion MAD in labor income (1.2% increase), 1.9 billion MAD in land income (1.3% increase), and 7.8 billion MAD in capital income (1.3% increase).

**The estimated cost-effectiveness of the diverse measures included in the GGS calls for in-depth evaluation of their impacts.** According to the IO analysis, the total number of new jobs the Strategy would create is high, as value addition (1.2%-1.3%). Both the FDA<sup>2</sup> and the Irrigation and Development of Agricultural Space<sup>3</sup> are estimated to generate about 2 million MAD for every million invested (about US\$ 100k). The FDA is projected to create about 19 jobs per every million invested. Other measures of the GGS

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<sup>2</sup> Measures included under “FDA” in the IO analysis include: subsidy for drip irrigation; animal intensification (subsidies for live animal imports); plantations; farm equipment; export promotion; support to fresh product processing; subsidies for agricultural Insurance; subsidies for organic certification, and others (other subsidies (Subsidies on the cost of laboratory analyses, on the purchase and storage of certified cereal seeds; emergency drought program; support for inter-professional organizations, etc.).

<sup>3</sup> Measures included under “Irrigation and development of agricultural space” include: irrigation investments; PNEE (network modernization for water saving); PEI (development of new irrigation areas downstream of dams), PPP (notably seawater desalination), other programs (ex. Livestock rangelands).

appear to have higher job-creation potential, such as Human Capital<sup>4</sup> (28 jobs/million MAD) or Solidarity Agriculture<sup>5</sup> (21). However, an *in itinere* evaluation of these measures (FDA in particular) is required to further test these preliminary findings, as the model remains too aggregated to fully capture all the effects of these measures. Indeed, it would be highly beneficial to evaluate the separate effects of the measures included in these aggregated policy packages.

**Greening further the GGS would have significant economy-wide effects, creating 178,328 additional jobs over 2021-2030, increasing the annual output by 20.3 billion MAD and household income by 8.8 billion MAD.** Yet the impacts on labor, land, and capital incomes are marginally lower than in the Baseline scenario. These positive market prospects of a greener agrifood sector in Morocco suggests that a greener agrifood policy would be a good climate and development choice for the country.

#### B. Boosting conservation agriculture and organic farming across Morocco would generate economy-wide positive impacts.

**Amidst dwindling and erratic rainfall, climate-smart agricultural practices, particularly conservation agriculture such as no-tillage farming, are vital for enhancing the resilience and sustainability of cereal-based systems and for the betterment of soil health.** No-tillage farming, a significant shift in crop management, reduces or eliminates ploughing and retains crop residues as ground cover. A 2021 study by the International Center for Agricultural Research in the Dry Areas revealed that no-tillage farming led to a 16% increase in yields, a 20% cut in total production costs, and considerable time savings. The research confirmed that for soft wheat, no-tillage is more cost-effective than traditional tillage, as it allows farmers to bypass certain ploughing operations. The labour saved is substantial and can be redirected to enhance livestock and crop production. In forage-based systems, the transition to no-tillage farming is estimated to save about 25 Liters of diesel fuel per hectare compared to conventional tillage. As part of the GGS, the government of Morocco has set an ambitious target of increasing the no-tillage area from the current 170,000 in 2024 to 1.0 million hectares by 2030 (up from 30,000 hectares in 2021).

**Morocco is strategically expanding its organic farming and certified products sector.** This aligns with the need to reduce reliance on costly fertilizer and pesticide imports and meets the targets of nationally determined contributions, resonating with the environmental policies of major trade partners like the EU Green Deal. The organic farming area has grown from 4,000 to 12,000 hectares between 2011 and 2019, and the Green Generation Strategy (GGS) now targets 100,000 hectares of certified organic farms by 2030. Efforts to develop labels that signify origin and quality are also underway.

**What would happen to Morocco's economy and to jobs if such green agricultural practices were adopted country-wide?** Two stylized scenarios have been tested based on two practical examples of the greener practices that could be scaled up in Morocco: no tillage practices, as one of the main measures of conservation agriculture, and organic farming for specific crops. These were assessed using the 2018 Morocco SAM (Psaltopoulos, 2024). First, primary data on production costs and net margins was utilized for no tillage practices in rainfed soft wheat and forage (ICARDA, 2021) and for the organic cultivation of irrigated olive trees, potatoes, tomatoes, and strawberries (Rafrafi, 2024). This data was combined with the 2018 SAM for Morocco and new sector-specific coefficients were estimated for each activity. Using the

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<sup>4</sup> Measures included under "Human capital" include supports to agricultural extension services and training centers.

<sup>5</sup> Measures included under "Solidarity agriculture" include targeted subsidies for youth and women farmers in fragile areas (ex. plantations, hydro-agricultural development, processing units, etc.).

standard Leontief procedure, estimates were obtained on the impacts (compared to the 2018 baseline) of changes in the production function of the above activities. No tillage is supposed to be applied to 50% of the area cultivated with soft wheat and all rainfed forage in the baseline year. Full conversion of olive trees, potatoes, tomatoes, and strawberries to organic farming is assumed.

**A green transformation of significant agricultural systems in Morocco, would generate positive economy-wide impacts.** Total annual average employment effects are projected at a gain of 53,112 jobs (+0.49% of baseline year employment). Also, there are very notable positive labor income (+0.81%), output (+0.63%), household income (+0.33%), and capital income (+0.02%) effects. Land income effects are negative (-2.81%). Positive employment effects are justified by the fact that sectors associated with input demand by certain types of green practices (see below) are more labor-intensive than those facing demand by conventional farm practices. These results do not account for a wide array of additional positive externalities, such as the benefits of the greening in terms of soil improvement, emission reduction, pollution reduction, cereal import substitution, etc.

**More specifically, the adoption of no tillage would increase agricultural output and employment, among others.** This is because the effects of the increase in yields due to no-tillage outweigh the marginal losses attributed to lower (compared to conventional practices) interindustry linkages of conservation agriculture. Positive impacts are estimated for no tillage in soft wheat, especially for land income (+1.91% compared to the baseline), output (+0.35%), capital income (+0.18%), employment (+0.12%), and household income (+0.07%). In the case of forage there are negative impacts on land income (-1.98%) but positive on employment (+0.05%).

**Organic farming would have overall positive effects on employment and labour incomes, but with variability across value chains.** This is especially valid for organic tomatoes, which could have the potential to be a key export product for Morocco, following the trend of conventional tomatoes. In more detail, organic tomato cultivation generates notable positive economy-wide effects on employment (+0.23% compared to the baseline), labour income (+0.60%), household income (+0.23%) and output (+0.14%). Similarly, organic potato cultivation generates the same positive economic effects but at a lower scale. Both activities generate negative effects on land income (-0.39% for potatoes and -0.23% for tomatoes). In general, and except for employment (-0.06%) and land income (-2.01%), organic olive tree cultivation generates marginally negative economy-wide impacts. Finally, economy-wide impacts of organic strawberry cultivation are marginal, except for labour income (+0.07%) and land income (-0.11%). These results call for a more detailed and careful analysis at the subsector level.

**While public incentives are needed to foster greener practices in Morocco, particularly conservation agriculture, financing mechanisms exist to alleviate the budget cost.** While there is a market price premium for organic produce, particularly on the export market, there isn't currently one for low-carbon production. Conservation agriculture in Morocco is indeed mostly being developed to farm cereal and leguminous for the national market. Public incentives are thus needed to finance the transition cost required to yield the public good of improved soils and better carbon storage. However, carbon finance also provides alternative financing.<sup>6</sup>

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<sup>6</sup> The World Bank is partnering with different private and public entities to develop a Measurement, Reporting, and Verification (MRV) mechanism to trace carbon emission reduction related to the shift from conventional to conservation agriculture systems.



### C. Using the virtual water balance to balance trade, domestic production and water availability

- Morocco case (Note 6)

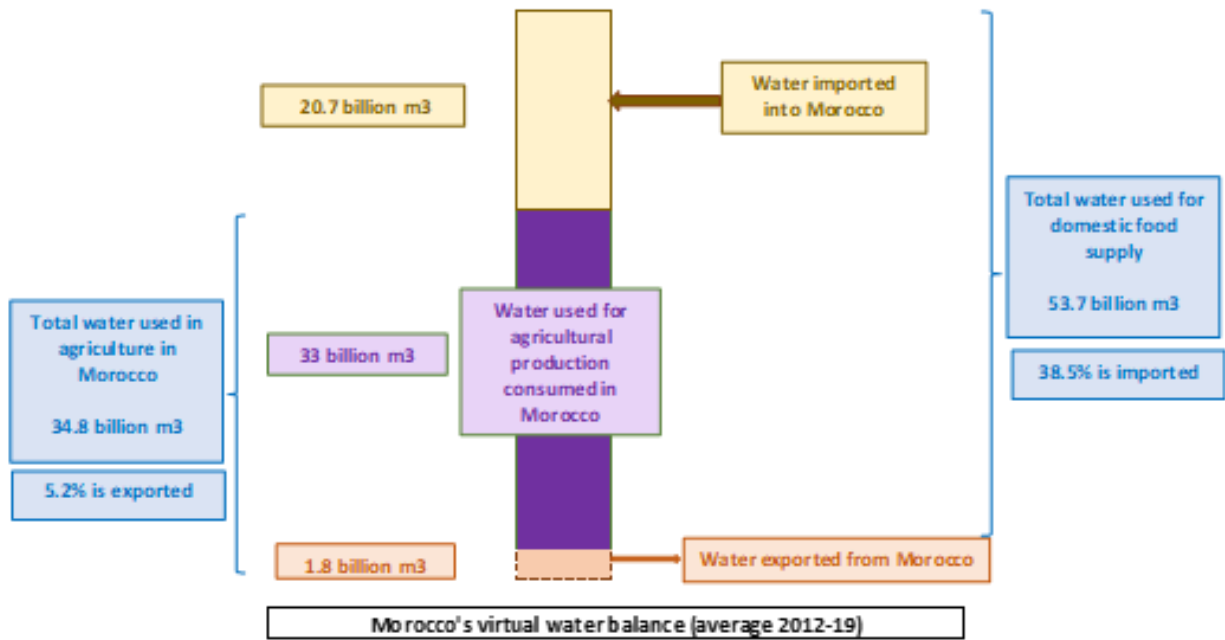
**A dilemma that many countries face in Maghreb is whether to use their scarce water resources to produce profitable and resource efficient crops (such as fruits and vegetables), but that are typically exported, or less efficient crops (such as grains), essential for domestic food consumption needs.** One tool to shed light on the tradeoffs implied in trade and domestic production policy decisions is the use of virtual water (or water footprint). The virtual water of a product is defined as the total volume of freshwater used to manufacture it (Hoekstra et al., 2009), and falls into three categories: (i) blue water refers to the volume of surface and groundwater lost to evapotranspiration; (ii) green water refers to rainwater consumed; and (iii) grey water refers to the volume of freshwater needed to dilute the pollutant load according to existing water quality standards.

**The volume and values of water flows and virtual water used by the agri-food system in Morocco were estimated over the period 2012-2019** (Note 6). The analysis considers both the water consumed for food production on Moroccan territory, under rain-fed and irrigated conditions, and the virtual water flows for both exported and imported agricultural commodities. Data on production, exports and imports of agricultural commodities came from the 2018 Social Accounting Matrix (SAM) developed by the World Bank team under the previous ASA. The virtual water values used come from the work of UNESCO-IHE1.

**Morocco imports 11 times more virtual water than it exports** (Figures 7 and 8). Over the period considered, agricultural production in Morocco used an average of 34.8 billion m<sup>3</sup> of water per year. Of this total, 1.8 billion m<sup>3</sup> were exported (i.e., 5.2 percent of the water consumed in Morocco). Virtual water imports amounted to 20.7 billion m<sup>3</sup> per year (i.e., 38.5 percent of the final balance of agri-food products consumed in Morocco).

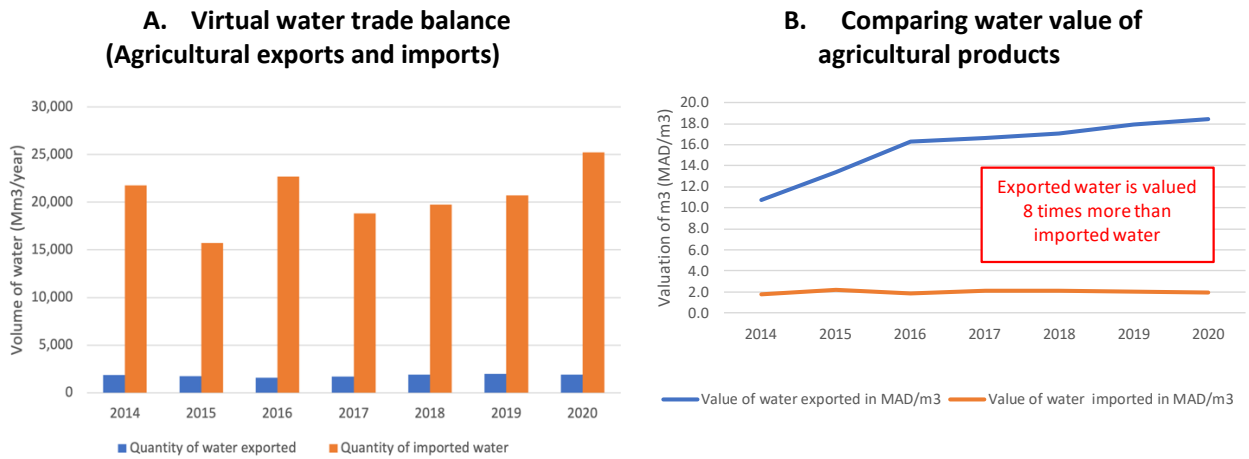
**The value of exported water (citrus fruits, fresh vegetables) is 8 times greater than that of imported water (cereal products),** which constitutes a commercial strategy adapted to the context of growing water scarcity. The value of exported water had been steadily and rapidly increasing from about 11 MAD/m<sup>3</sup> in 2014 to 18 MAD/m<sup>3</sup> in 2020, reflecting increasing scarcity.

Figure 7 - Virtual water balance of Morocco's agrifood systems



Source: authors (Note 6), based on 2018 SAM and UNESCO-IHE1 data

Figure 8 - Water Trade Balances by Quantity (A- Left) and Value (B- Right) of Agricultural products



Source: authors (Note 6), based on 2018 SAM and UNESCO-IHE1 data

Cereals accounted for most of the domestic water used for farming in Morocco (40.5%), followed by fruit trees (28.4%), vegetables and berries (14.6%)(Figure 8). Citrus fruits and oils, along with olives, both at 20 percent, took up the highest shares of the virtual water exports (1.8 billion m<sup>3</sup> per year), followed by vegetables (notably cherry tomatoes) and berries (15%). Virtual water imports (20.7 billion m<sup>3</sup> per year) came mainly from cereal products (55%), followed by oilseed products (15%) and animal feed products (13%).

**Water availability being the major constraint for agricultural production in Morocco, imports of virtual water are projected to further increase while exported water will require stabilization.** Despite efforts to mobilize water using dams, transferring watersheds, and using desalination for drinking water in major coastal cities, the reduction in surface water supplies and the necessary control of the overexploitation of groundwater will likely lead to a reduction in available water quantity on Morocco. Development of non-conventional water (like desalinated water for irrigation) could eventually go to a maximum of 0.5 billion m<sup>3</sup> per year. These volumes, which are used mainly for export crops, could partly replace conventional water volumes. Even taking this replacement into account, the country water resources are highly unlikely to withstand exported water volumes higher than 1.8-2 billion m<sup>3</sup> per year. Population growth and changing dietary habits, combined with the reduction in water available at the national level, are expected to keep on increasing the volume of imported water in the future.

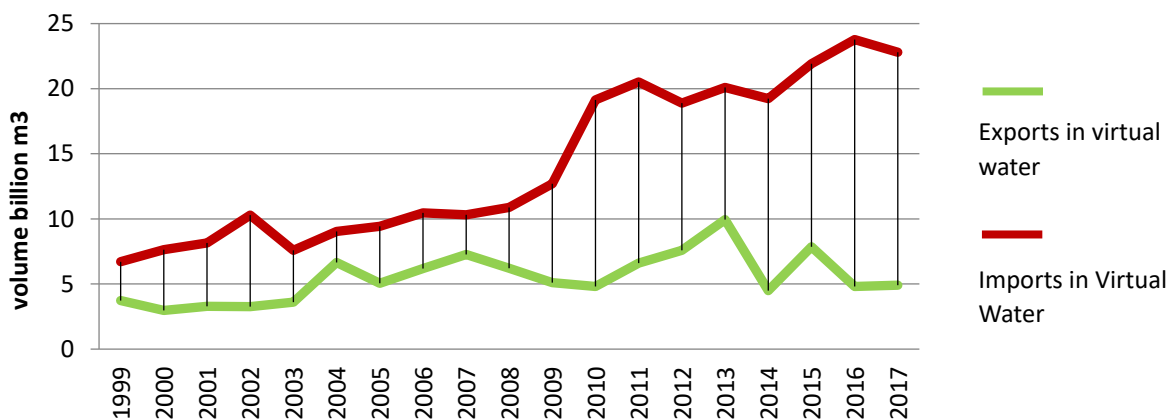
**As Morocco considers changes to its agri-food system both in agricultural production and food processing, water scarcity should be analyzed.** Actions and policies can be developed to ensure that Morocco's virtual water trade balance remains positive, especially as production shifts to more climate-resilient crops and efforts are made to increase food processing.

- Tunisia case (Note B)

**Between 1999 and 2010, Tunisia's virtual water imports were double that of its exports, a disparity that widened to three to fourfold from 2010 to 2017.** Employing the methodology applied to Morocco (refer to the previous section), this analysis spans 1999-2017, utilizing data from the Tunisian Ministry of Agriculture (ONAGRI-MARHP). Throughout this period, Tunisia's agri-food system and natural ecosystems utilized an annual average of 38.7 billion cubic meters (m<sup>3</sup>) of water. Of this, rainfall contributed 93% (approximately 35.9 billion m<sup>3</sup>), while blue water resources—comprising surface and groundwater evapotranspiration—accounted for 7% (2.8 billion m<sup>3</sup>). Grey water, the volume required to assimilate pollutants as per water quality standards, was minimal. Out of the total 37.7 billion m<sup>3</sup> used, 5.4 billion m<sup>3</sup> were exported, representing 14%. Virtual water imports averaged 14.2 billion m<sup>3</sup> annually, or 36.69%, and saw a significant increase, more than tripling from 6 billion m<sup>3</sup> in 1999 to 22 billion m<sup>3</sup> in 2017.

**Tunisia mostly exports virtual water through olive oil and its derivatives, and mostly imports it for cereals and feed.** The country's virtual water exports are primarily through olive oil, constituting 53%, and its by-products, such as margarine, at 20%. Dates contribute 7%, while citrus fruits represent a mere 1%. The export landscape has evolved over time, with citrus fruits being replaced by other processed goods like vegetable oils and cereal products. Concurrently, the proportion of dates has consistently grown, doubling during the analyzed timeframe. On the import side, the majority are goods for human and animal consumption. Soybeans, both beans and cakes for feed, represent 40% of imports on average, with a notable uptrend, indicating a growing reliance of the livestock sector on international markets. Cereals, including wheat, account for 39% of imports and have remained relatively stable, while vegetable oils and sugar represent 9% and 6%, respectively.

*Figure 9 - Comparative Evolution of imports and exports of virtual water in Tunisia (billion m<sup>3</sup>/year)*



**The value of both exported and imported virtual water tripled between 1999 and 2017.** The surge in export costs is largely due to the rising prices and volumes of exported olive oil, alongside worsening water scarcity. Over the period studied, the value of exported water is 3 times greater than that of imported water, reflecting water scarcity in Tunisia. These figures do not reflect the impact of recent droughts, which are likely to have continued or even intensified these trends.

**A comparative analysis with Morocco suggests that Tunisia could improve the economic returns on its exported virtual water and strategically direct its water imports towards human consumption.** Tunisia's overall virtual water consumption is 10 percent higher than Morocco's, at 34.8 billion cubic meters, which can be attributed to Tunisia's larger agricultural area—9.7 million hectares, compared to Morocco's 8.7 million. Yet Tunisia's virtual water exports are three times greater than Morocco's, at 1.8 billion cubic meters, and its imports are 30 percent lower, at 20.7 billion cubic meters. Considering Tunisia's escalating and critical water scarcity, these insights highlight the imperative for enhanced water use efficiency in both rainfed and irrigated sectors, as well as improved management of the national water supply and demand.

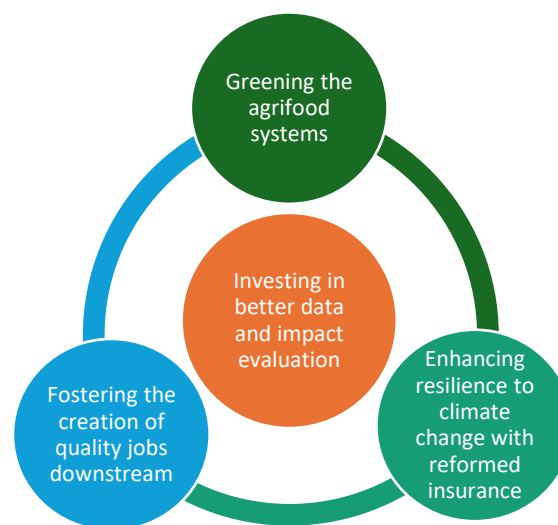
#### Box 3. Work dissemination and use in Morocco

The disaggregated Social Accounting Matrix (SAM) for agriculture was finalized during the previous ASA phase and has been used during the current engagement for partial analyses that have proven timely and important for informing ongoing policy dialogue. For instance, the policy note on virtual water was built on some outputs of the SAM and was widely disseminated in Morocco and Tunisia as an example of virtual water balance. It was, amongst other, presented in Morocco in a High-level panel for the SIAM (International Fair of Agriculture in Morocco). In parallel, the SAM was used for conducting a detailed IO analysis that looked at the impacts of various scenarios on sector employment and value added. In particular, the findings on conservation agriculture and greener production practices are useful for informing the preparation of the new operation in the agricultural sector in Morocco.

## IV. Recommendations

The key policy recommendations that stem out of the work achieved under the “Maghreb: policy engagement for resilient and inclusive agrifood systems” fall under four axes, developed here after. The first is to continue the greening the agrifood systems of Morocco and Tunisia, by financing the switch to more environmentally friendly practices and improvement of the management of water rationing. The second is to further enhance their resilience to climate change by reforming agricultural insurance programs, in particular for rainfed agriculture. The third is to foster the creation of quality jobs in more efficient and inclusive value chains, with a stronger emphasis on food processing and value addition. Finally, investing in better data and impact evaluation is of paramount importance to build better and more cost-efficient agricultural policies that support the effective implementation of the three previous axes. The section concludes by proposing an analytical agenda for the next two years.

Figure 10 - Recommendations axes



### Axis 1: Upscaling the greening of agrifood systems

#### 1.1 Transitioning to more environment-friendly practices

**A robust and integrated approach to public support and policies is needed for a transition of the agriculture sector of Morocco and Tunisia towards more sustainable and more resilient practices.** In Morocco, the ambitious goal to increase no-tillage areas from 30,000 hectares in 2021 to 1 million hectares by 2030 requires scaling up the current implementation efforts. A comprehensive roadmap was prepared by the WB in cooperation with partners and should be implemented, leveraging insights from the Al Moutmir program and the current public financing (FDA) and innovative financing (climate finance). Measures to consider include: enhancing agricultural advisory services through demonstration plots, farmer field schools, and training for advisors and farmers; integrating oilseeds into crop rotations; promoting service companies and aggregation for advisory and machinery services, especially seeders; and creating innovation platforms with soil viability maps for direct seeding.

**The expansion of no-tillage farming also depends on the private sector's involvement and access to green financing.** Developing risk-sharing facilities could attract private investment for the local production of seeders and the provision of necessary equipment and inputs for the broad adoption of conservation tillage. Financing this roadmap could benefit from international green funds due to its contributions to climate adaptation and mitigation, food security, and support for small and medium-sized farms.

**Additionally, fostering resilience and job creation in agriculture requires the promotion of organic farming and drought-resistant crops.** Organic farming and the establishment of quality and origin labels are essential for minimizing agriculture's environmental footprint and accessing new markets. The government's continued support for drought-resistant perennial crops, such as argan and carob trees, is crucial for adapting rainfed agriculture to climate variability and change.

## 1.2 Improving the management of water scarcity

**To bolster water security, Morocco and Tunisia might consider revising their investment strategies and governance of the water sector to better meet future challenges, while also strengthening water governance.** The current investment strategies aim to mitigate water scarcity by diversifying sources, interconnecting systems to reduce regional disparities, and maximizing storage in surplus years to offset variability. The next step is to refine tools and procedures for optimal water management and to protect both natural resources and infrastructure.

**Aquifers are pivotal in water management and should be protected as a national priority** through a comprehensive program that includes robust legal support, improved knowledge, consensus-building among users, institutional arrangements, and proactive recharge during wet years, similar to surface water strategies using dams. Solid decision-making models that incorporate climate scenarios should guide new investments in inter-basin transfers and unconventional water resources, such as desalination and wastewater reuse, considering both cost and environmental impact.

**Water demand management and conservation policies must be implemented alongside technological upgrades to keep water withdrawals sustainable and manage variability.** Policies to consider include enforcing sustainable aquifer management, defining and enforcing transferable water quotas, conditioning subsidies on sustainable water use, providing better advisory services for farmers, and using tariffs and fees as incentives for efficient water use. These policies, already in place, could be scaled up and tailored to the specific conditions of Morocco and Tunisia.

**Revisiting water pricing is essential for sustainable management.** Enforcing fee payment with tradable quotas can ensure flexibility and allocate water to the most valuable uses. Information on operation and maintenance cost recovery for public schemes should be frequently updated, and water pricing could be differentiated by user type or service quality. The discussion on tariffs is closely linked to service quality, including reliability, and currently, farmers do not receive compensation for losses due to rationing.

**As water scarcity increases, the Maghreb should ensure that water exports are of the highest value and from sustainable sources, avoiding groundwater depletion.** The work on virtual water can inform crop diversification strategies. Indeed, it is advisable to avoid using scarce water for low-value crops like cereals with supplementary irrigation except when the cost-benefit ratio will be favorable (low cost of water mobilization and huge marginal benefit of each m<sup>3</sup>) and renewable water available. Instead, investing in conservation agriculture, optimizing rainfed conditions, and considering imports over unsustainable irrigated cereal production at large scale would be strategic choices.

## Axis 2: Enhancing resilience to climate change by reforming agricultural risk-management programs

**As drought has become a recurrent, structural problem in Morocco and Tunisia, risk management cannot rely exclusively on ex-post plans.** Ex-ante drought management must be an integral part of agricultural policies through climate-smart agricultural practices and technologies as described above. The enhancement of climate risk management tools, including crop insurance and macro-insurance coverage, is also essential.

**Key to bolstering resilience is the expansion of crop insurance access for small farmers, particularly in rainfed agriculture.** For the crop insurance system to be more inclusive and appealing, a robust data infrastructure is required to refine insurance product design. Subsidies for insurance premiums should be strategically directed towards the smallest and most vulnerable farmers. Learning from global practices to implement index-based insurance systems that utilize advanced technologies, such as earth observation and big data, is recommended. To attract new entrants to the insurance and financial sectors, a competitive business environment must be fostered. Linking insurance with agricultural loan products can enhance sustainability, while capacity building for farmers and insurers is crucial. Diversifying marketing channels through farmer organizations and intermediaries, such as cooperatives, producer groups, aggregators, input suppliers, and telecom operators, will further extend the reach and effectiveness of these insurance products.

**In Morocco, an efficient adaptation strategy could be to have a spatial approach to risk management tools, differentiating between:**

- **Areas that will remain favorable to intensive cereal cultivation:** they are estimated at one million hectares. On these, a 50% yield increase appears technically possible thanks to (i) conservation agriculture (mainly zero-tillage, long crop rotations, precision fertilization, phytosanitary treatments by decision support tool (DST) according to annual weather patterns) and (ii) the use of certified seeds adapted to drought and reduced vegetative duration. These climate-smart practices would enable to secure 3 to 3.5 million tons of annual grain production. Supplemental irrigation on surfaces equipped for Large Scale Hydraulic Irrigation, insofar as the benefit exceeds the marginal cost (depreciation of equipment and price per m<sup>3</sup> of water), could also increase yields to reach an annual production of 3.5 to 4 million tons on these hectares. Intensification in favorable cereal-growing areas would require investment and therefore economic security through market risk management combined with technical yield management. A suitable commercial insurance system would be needed, driven by the private sector within a framework set by public authorities;
- **Areas that will require diversification away from cereal intensification:** these less productive areas will require diversified agriculture adapted to climatic conditions. The land area concerned could reach 2 million hectares by 2030-2035, as forecast by the SGG, or even 3 to 4 million hectares by 2060, if farms are able to adapt to climate change with temporary aid as quickly as possible. With efficient adaptation measures, these areas could produce between 1 and 3 million tons of additional cereals, depending on annual weather conditions. In the event of extreme climatic events, they would need to be financially supported by national solidarity as the climatic risk would be too high to be covered by insurance companies. A parametric subsidy or direct income support could be proposed to supplement the income of farms in their transition phase towards a new economic

equilibrium (e.g., transition of production types by substituting forage sorghum for historical forage barley production), for mixed crop-livestock farms, or conversion to new crops such as cactus, carob, etc. In addition, losses from agricultural catastrophe (in uninsurable areas) could be included as part of the dialogue on eligible expenditure under the new Rapid Response Option (RRO).

Detailed recommendations for both types of insurance systems are detailed in Note 1.

**Macro-insurance coverage against drought is also an option.** To effectively manage the fiscal impact of increasingly frequent and severe droughts, countries must finance emergency plans without destabilizing their budgets. Macro-insurance programs, such as weather derivatives, offer a solution by allowing states to insure with international insurers or reinsurers and spread the risk globally. These programs operate through a single contract between the state and the insurer, with an annual premium. Upon the onset of a crisis, the insurer compensates the state with funds to support its drought program, based on predetermined criteria from a parametric insurance index, like the normalized difference vegetation index. The compensation amount is calculated using a model that correlates the climate index with the drought program's costs. Beyond drought, there is potential to insure against other risks, such as spikes in international commodity prices, using mechanisms like catastrophic deferred drawdown options.

### Axis 3: Fostering the creation of quality jobs in more efficient and inclusive value chains

**To stimulate the creation of quality, sustainable employment in the agrifood sector of Morocco and Tunisia, seven key recommendations are proposed:**

- 1) **Continue investing in education and capacity building:** Enhancing general education and vocational training, along with policies that encourage youth participation, can boost employment in rural areas. Initiatives to adapt educational curricula should be a key area of collaboration with relevant ministries and institutions. In Morocco, for instance, the Hassan II Agronomic and Veterinary Institute's data science program is preparing graduates for the digital transformation of agriculture, while the Directorate of Education, Training, and Research is focusing on training trainers in agricultural entrepreneurship. The new skills required due to climate change also need to be addressed.
- 2) **Enhance job attractiveness:** Strengthening the legal framework is crucial to protect informal agricultural workers and transition them into the formal economy. With approximately 90% of agricultural workers informally employed in Tunisia and Morocco, policies should guarantee basic rights such as leave entitlements, work breaks, organizational rights, pension plans, and medical and unemployment insurance. Targeted initiatives, like Morocco's regional centers for rural youth entrepreneurship under the Green Generation Strategy (GGS) and with World Bank support, can empower young agricultural entrepreneurs with necessary resources and guidance.
- 3) **Foster diversification of rural activities:** To counter the younger generation's aversion to primary agriculture due to perceived low wages and harsh conditions, the governments can enhance rural business competitiveness and improve living standards by upgrading social infrastructure—roads, schools, hospitals, electricity, and water networks. Strengthening digital infrastructure is also vital for remote service delivery and regional development.
- 4) **Upscale digitalization:** Embracing digital technologies can simplify services and create a more integrated and efficient agricultural labor force, enhancing productivity and appealing to the youth. Technologies like smart farming, sensors, drones, and blockchain can help farmers to better utilize



inputs and increase outputs. Universities could adapt their curricula to future needs, and an ecosystem conducive to digital development could be established, with clear roles for public and private stakeholders. Investments in the digitalization of public agricultural services and connectivity in rural areas are imperative.

- 5) **Invest in gender equality:** The agricultural sector's reliance on the often-unpaid labor of rural women, who earn significantly less than their male counterparts, highlights the need for gender-focused policies. Empowering women in agrifood systems through equal pay, formalizing their labor, gender-neutral inheritance laws, participation in land management, and protection against harassment will significantly contribute to their economic empowerment and sector productivity.
- 6) **Improve financial services:** Enhancing farmers' and rural populations' financial inclusion can lead to increased agricultural productivity. This can be achieved by refining financial support programs to reach the most marginalized, fostering private sector competition in agrifinance, promoting financial literacy, advocating for digital finance adoption, and encouraging cooperative formations.

Implementing these recommendations will not only improve the quality of employment in the agrifood sector but also contribute to the overall economic resilience of Morocco and Tunisia.

#### Axis 4: Investing in better data and impact evaluation for better and cost-effective policies

**In the pursuit of informed policy-making, the strengthening of agricultural statistics systems is paramount in Morocco and Tunisia.** Decision-makers require access to timely and accurate data to navigate constraints, evaluate outcomes, monitor progress, gauge policy impacts, and adjust strategies to meet the dynamic needs of development. Establishing robust mechanisms for the collection, storage, and dissemination of food and agricultural statistics, coupled with a solid monitoring and evaluation framework, is essential for these objectives. Technological advancements have revolutionized data collection and dissemination tools, presenting an opportunity for governments to upgrade their agricultural information systems. To support this data expansion, the mobilization of sufficient human and financial resources is necessary, as well as the adoption of improved data collection tools.

**Emerging challenges such as climate change, environmental sustainability, food security, and health crises underscore the urgency for enhanced data capabilities.** In Morocco, for instance, expanding data collection to encompass agricultural income, production costs, employment in both upstream and downstream sectors (with a particular focus on women's jobs), and the full scope of the agrifood system—including intermediate consumption and private irrigation—will provide critical insights for the Green Generation Strategy (GGS). Conducting new agricultural censuses in both Morocco and Tunisia could reveal the impacts of recent droughts on the agricultural sector, informing future resilience measures.

**Enhancing governance and cross-sectoral coordination for data sharing is another priority.** Currently, there is a disconnect among entities responsible for the production, management, and analysis of agricultural and agrifood data. Establishing regulations and protocols for data sharing among various authorities, such as Morocco's MAPMDREF, High Commission for Planning, and the Ministry of Economy and Finance, will facilitate better interagency collaboration and data accessibility for both private and public stakeholders.

**Impact monitoring and policy evaluation in the agrifood sector are critical for improving policy effectiveness and efficiency, particularly under increasing fiscal constraints.** Comprehensive impact

assessments of budgetary investments (such as the effects of FDA subsidies on groundwater usage or the impact of investment support for agribusinesses in Morocco) would enable Maghreb countries to refine their policies for greater efficacy and contextual relevance.

**The mid-term review of Morocco's GGS presents an excellent opportunity to realign objectives and policies with the realities of a water-scarce and climate-extreme environment.** This could include a focus on rainfed cereal agriculture, incorporating climate-smart agriculture and insurance, and advancing water rationing management for irrigated agriculture through robust water policies and technologies. The GGS's ambitious goals, with their complex cross-sectoral dimensions, demand a strategy grounded in precise information, effective decision-making tools, and continuous updates to ensure the achievement of its vision.

### Looking forward: an analytical agenda

**The work done under the current PASA underlines the key challenges that the agri-food systems in Morocco and Tunisia are facing but reveals wins within reach.** Facing increasing climate pressure, these food systems must continually change and adapt. In this regard, the PASA provides detailed recommendations on how risk management in agriculture can be improved, including through reforming agricultural insurance, and on how the true costs of food production and trade, especially (virtual) water, can be better understood and managed. This is particularly important given that, in absence of mitigation measures, supply shocks – such as droughts – have severe socio-economic impacts on the agri-food sector and economy overall. At the same time, the PASA highlighted major opportunities to enhance the resilience of the agri-food systems in Morocco and Tunisia. In particular, boosting green agricultural practices, especially conservation agriculture and organic farming, can deliver significant benefits at scale, notably through an overall increase of farmer incomes and their stabilization in face of shocks, and through net employment generation.

**The PASA also puts a spotlight on areas that need to be better understood and further developed, going forward, to create a more inclusive and equitable agri-food system and to improve the related decision tools.** Rightly so, policymakers are increasingly focusing on the human capital in the agri-food system, and on ways to leverage and capitalize it better. The Green Generation Strategy in Morocco is explicitly committed to this goal. At the same time, our work shows that Morocco and Tunisia are still under-utilizing their human potential in the sector. The results of the PASA show that investing in food processing and strengthening the backward and forward linkages in agriculture would create important multiplier effects in terms of employment and value creation in the economy. To achieve this, sector interventions need to be well targeted, and evidence based. However, the PASA also reveals that policy makers currently lack the tools they need to best support them in achieving these goals.

**A priority for an analytical agenda for Morocco and Tunisia would be to strengthen the government's statistical capacity for measuring employment-related data in the agri-food sector.** As the sector is a major employer for women, a specific effort could be made to better understand female jobs, and what has worked to improve the quality of these jobs for women. In addition:

- **In Morocco:** for the Government to effectively gauge the impact of its policies on job creation and inclusivity beyond primary production, it is essential to enhance data quality. A centralized data collection system at the Directorate of Strategy and Statistics is vital for the Generation Green Strategy 2020-2030. This system will consolidate information from various entities involved in employment and

agricultural entrepreneurship, enabling the Ministry of Agriculture to monitor the agrifood sector's employment landscape in real-time. This will support evidence-based policy-making and program evaluation. Additionally, the system will enhance transparency and resource management accountability. Considering a technical assistance for the establishment of a permanent agricultural employment observatory could further ensure ongoing data updates and facilitate strategic decision-making based on robust analysis.

- **In Tunisia:** the lack of current and detailed statistical data on the agricultural sector's structure impedes the Ministry of Agriculture, Water Resources and Fisheries (MARHP) from crafting policies that address the sector's immediate needs. Initiating the first General Agricultural Census (RGA) is crucial for the country. Moreover, enhancing statistical capabilities and tools to analyze the effects of policy on employment across the entire value chain is essential for informed decision-making.

**Second, policy evaluation could serve as a cornerstone for guiding decisions in a manner that is not only efficient but also cost-effective:**

- **In Morocco,** the 2025 mid-term review of the Generation Green Strategy (GSS) is a critical milestone. This review is an essential process that provides an opportunity to conduct a comprehensive policy evaluation, examining each initiative in detail to ensure that policy decisions are attuned to Morocco's emerging challenges, particularly the imperative of job creation and the resilience to climate change. A meticulous review will enable the recalibration of the GSS to address these national imperatives effectively, thereby ensuring that the strategy remains relevant and impactful in fostering sustainable agricultural development and employment opportunities.
- **In Tunisia,** the government's initiatives to strengthen the resilience of the cereal sector deserve special attention. These measures, while technical in nature, have the potential to be transformative, offering substantial prospects for agricultural growth and job creation. The actions taken over the past year could have significant implications for food security, employment, and the overall economy. A thorough evaluation of the impact of these measures on food prices, job creation, and investment attractiveness could provide deep insights for other value chains and comparable countries.

**Third, the urgency of scaling-up climate smart and sustainable agricultural practices in the Maghreb necessitates a comprehensive examination of the available policy instruments.** This includes advancing our understanding of risk management tools and how to support its development. For instance, additional work could support the delineation of commercially un/insurable areas and develop resilience roadmaps and investment plans for these two distinct geographies. It also means investigating how policies can directly incentivize greening efforts, which might require policy repurposing in some contexts. Assessing options such as decoupled payments and green incentives is critical, as these could significantly hasten the shift towards more sustainable systems in the Maghreb region. Alternative financing mechanisms for the greening of the food system could also be explored, including private sector investment and leveraging carbon finance opportunities.

**Finally, addressing the reduction of food loss and waste is not just a practical step but a strategic imperative for sustainable food systems, that demands substantial investment in knowledge.** In the Middle East and North Africa, 44 percent of food waste occurs post-production, with Moroccan households discarding an average of 34 percent of their food purchases (FAO 2013, 2014). FAO (2016) estimated that post-harvest losses in Morocco's fresh fruits and vegetables ranged from 20 to 40 percent.

To address this issue with the precision and effectiveness it warrants, conducting thorough assessments to update and refine our understanding of food waste and loss is critical. These assessments will not only illuminate the current state of food loss but also guide the development of targeted policy measures. Such measures will be instrumental in effectively mitigating this challenge and are a crucial component of the broader effort to transition Morocco and Tunisia's agrifood systems to more sustainable, green practices.

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