

SECTOR ASSESSMENT (SUMMARY): IRRIGATION

1. Sector Performance, Problems, and Opportunities

1. Agriculture is Nepal's primary economic sector; about 80% of the population is dependent on it. Since most of the poor reside in rural areas, Nepal's poverty reduction strategy recognizes that agricultural growth is essential for attaining broad-based growth and improving livelihoods. While declining as a proportion of gross domestic product (GDP), the sector has been growing at 3% since 2000 and contributes about 34% of GDP, 80% of exports, and 60% of employment.¹ Cereal production (primarily rice and wheat, but also pulses, minor grains, and maize) contributes about 50% of sector GDP, and livestock accounts for an additional 25%. Agriculture is largely based on low-value crops and subsistence production, with only about 17% of output traded in markets. Because agriculture growth has been erratic, determined to a large extent by climatic factors, food production remains unstable. Until about 1990, Nepal was a net exporter of food, but during most of the 1990s, particularly up to 1999, it had a food deficit. A positive balance was attained for a short period between 1999–2000 and 2004–2005, but this has since been reversed, with a negative food balance in 2005–2006 and 2006–2007. Even in times of a positive national food balance, most mountain districts (12 of 16) and more than one-third of hill districts report ongoing food deficits.

2. Agricultural production relies on a 4-month monsoon, when 75% of annual rains fall. Climate variability and change in Nepal is projected to exacerbate existing threats to food, water, and livelihood security through alterations in the quantity and timing of precipitation and runoff, more atmospheric water vapor and evaporation, and progressive loss of glacier and snowpack storage in basin headwaters.

3. Surface water irrigation systems in Nepal consist of those operated by users—farmer-managed irrigation systems (FMIS)—and those operated either fully by government or jointly by government and users—agency-managed irrigation systems (AMIS). FMIS are usually simple traditional systems created by farmers to divert water from both seasonal and permanent streams and rivers. Most use gravity distribution systems through open canals. The government began a program of assisting selected FMIS to upgrade their primary infrastructure because farmers cannot efficiently maintain temporary headworks, which are easily damaged by floods. Government intervention has focused on constructing permanent diversions and upgrading primary canals. FMIS renovation was also identified as an opportunity to strengthen water users associations (WUAs) with a proven track record of self-sustained operation and maintenance (O&M). Mostly small and medium in size, FMIS have good scope for enhancing productivity and expanding command areas at relatively low cost.²

4. Following a program of irrigation management transfer since the 1980s, WUAs are responsible for managing lower-level canals in all AMIS. Experience in Nepal shows that some systems may be more efficiently managed by WUAs than by government; the process of turning over O&M responsibility to capable WUAs is called irrigation management transfer. A key lesson learned from the Asian Development Bank (ADB)-financed Irrigation Management Transfer Project (1995–2004) was that full management transfer is more likely in small and

¹ ADB. 2013. *Preparation of the Agricultural Development Strategy, Final Report*. Consultant's report. Kathmandu (TA 7762-NEP).

² In Nepal, small schemes have a command area of less than 25 hectares (ha) in the hills and 200 ha in the Terai (the southern plains region), while medium schemes have less than 500 ha in the hills and 200 ha in the Terai.

medium-sized systems; some government management may still be needed for headworks and main canals in larger systems.

5. Of the 2.64 million hectares (ha) of cultivable land in Nepal, 1.77 million ha are irrigable and about 1.33 million ha have access to irrigation. Investments are required to rehabilitate and improve existing irrigation schemes and, for AMIS, to enhance operating efficiency by transferring scheme management from the government to WUAs, which have a vested interest in efficient water use. More efficient agricultural technologies, availability of inputs, along with the provision of supplementary irrigation during the monsoon season and full irrigation in the dry season can increase rice yields from around 3 tons per ha per year currently to as high as 10–12 tons per ha per year.³ The provision of guaranteed and dependable irrigation can also provide farmers with an incentive to diversify from low-value cereal crops to high-value crops such as fruits and vegetables, and increase their incomes and nutrition at the same time. A study in 2005 on irrigation and poverty showed that the incidence of poverty in irrigated areas is half that in rainfed areas and that access to irrigation water mitigates poverty.⁴

6. Sector experience demonstrates that significant productivity gains are possible with (i) better water distribution, (ii) more efficient water application, (iii) effective O&M systems, and (iv) greater cost recovery. This requires both quality fit-for-purpose infrastructure and effective WUAs. With the removal of constraints imposed by dysfunctional irrigation systems, farmers' willingness to invest in modern production practices increases. This increases food security and incomes for the farms and is particularly important for low-income households.

2. Government's Sector Strategy

7. A new Agriculture Development Strategy (ADS) was formulated in 2013. The ADS seeks to create "a self-reliant, sustainable, competitive, and inclusive agricultural sector that drives economic growth and contributes to improved livelihoods and food and nutrition security" (footnote 1). The ADS has four expected outcomes: (i) good governance, (ii) higher productivity, (iii) profitable commercialization, and (iv) increased competitiveness. Expanding irrigated areas equitably and viably, and improving irrigation efficiency and management are core outputs for a higher productivity outcome. The ADS emphasizes the expansion of irrigable areas by the most economic and equitable means while increasing irrigation efficiency and intensity, and improving the irrigation management of existing systems. The ADS proposes to complete ongoing surface projects, repair damaged surface schemes, repair damaged tube wells and develop new ones in the Terai, develop nonconventional irrigation in the hills, increase the effective area of existing schemes by improving system and on-farm management and by building headworks and improving the main canals of FMIS, and constructing tube wells in the tail of command areas as conjunctive use. The ADS also recommends inter-basin transfer schemes and implementation of irrigation management transfer. It calls for an integrated approach in which agricultural support and market development is combined with infrastructure investments. Key ADS strategies, approaches, programs, and targets are reflected in the government's Three-Year Plan Approach Paper (fiscal year [FY] 2014–FY2016).

8. The Water Resources Strategy (2002) and its National Water Plan (2005) emphasize the need for year-round irrigation services to increase the productivity of irrigated agriculture and

³ ADB. 2012. *Preparation of the Agriculture Development Strategy*. Assessment Report. Kathmandu (TA 7762-NEP).

⁴ International Water Management Institute. 2007. *Pro-poor Intervention Strategies in Irrigated Agriculture: Lessons from the Asian Experience*. Colombo, Sri Lanka (IWMI Water Policy Briefing 28).

extend the cropping seasons; the importance of a service-oriented management approach to provide more efficient, reliable, and flexible water services to farmers; and the progressive shifting of O&M costs to WUAs to enhance efficiency, equity, and sustainability.

9. The government's new irrigation policy, approved in June 2013, promotes (i) improvement of AMIS and FMIS to increase water efficiency and achieve year-round irrigation; (ii) development of large and modern irrigation systems, including inter-basin water transfer and reservoir-type systems; and (iii) conjunctive use of surface and groundwater. It calls for institutional strengthening of both the government and farmers through organizational reforms, human resource development, and capacity building. The policy commits to gender equity and social inclusion in irrigation, and encourages beneficiary consultation and participation at every stage of project implementation. It stipulates the degree of beneficiary contribution depending on the type, size, and nature of the infrastructure investment, and calls for the collection of irrigation service fees to fund routine O&M. Management transfer to farmers could be full or partial depending on the capacity of their WUAs. Irrigation systems should be environmentally sustainable, and resilient to climate change and natural disasters. Irrigation, agriculture, and local development agencies should collaborate more closely.

10. The major constraints to successful implementation of these strategies are funding and capacity. Investments in water resource management (with the exception of tube wells) tend to be capital-intensive and thus costly to implement on a wide scale. Despite the benefits and potential of such investments, without funding support they are unlikely to be implemented. Capacity constraints are both institutional and individual. Suitable institutions for irrigation and agriculture exist in Nepal but are in separate ministries, and collaboration for irrigated agriculture projects needs to be coordinated. Individual capacity constraints relate to the capacity of individual government officers involved with water resource management as well as the capacity of farmers and end users to understand and adopt improved agriculture and water management practices. Nonetheless, careful project design can overcome these constraints, and successful water resource projects have indeed been implemented.

3. ADB Sector Experience and Assistance Program

11. ADB has been a principal development partner in Nepal's agriculture sector and began its engagement in the irrigation subsector in 1971. Total investments in agriculture so far exceed \$250 million. Under the country partnership strategy (CPS) for 2010–2012, ADB provided support for (i) enhancement of agricultural productivity through irrigation; (ii) crop diversification and commercialization; (iii) widening of access to agricultural inputs and markets through investments in expansion of rural transport infrastructure; and (iv) policy formulation, including development of the ADS. During the new CPS period, 2013–2017, ADB will support investments in water management improvement to expand irrigation and mitigate risks of flooding, and explore innovative investment modalities for expanding the rural road networks. The approach is consistent with the findings of a review of ADB's performance in Nepal's agriculture and natural resources sector by ADB's Independent Evaluation Department in 2011, which recommended that ADB (i) reduce subsector spread and focus on priority areas, and (ii) increase investment in rural infrastructure such as irrigation.⁵

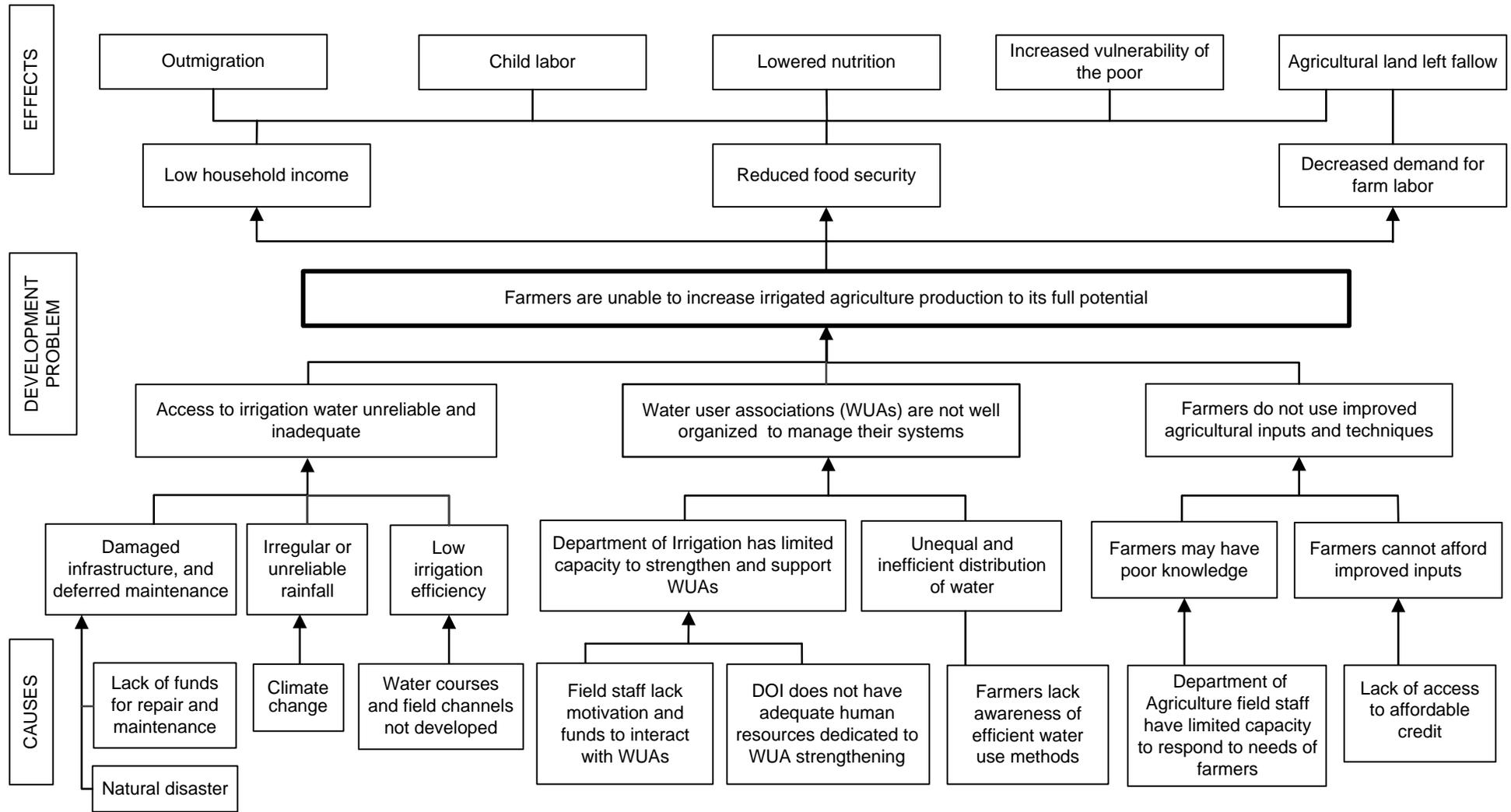
12. In the irrigation subsector, ADB has focused on expanding irrigated areas by using surface and groundwater, and building capacity of local governments and institutions. The

⁵ ADB. 2011. *Sector Assessment Performance Evaluation: Agriculture and Natural Resources Sector*. Manila.

ongoing \$13.8 million Water Resources Project Preparatory Facility finances the detailed design of irrigation projects, allowing civil works contract packages to be ready at loan signing and expediting project implementation.⁶ Irrigation projects will (i) empower line agencies to play a facilitative role, (ii) incorporate participatory subproject planning to empower WUAs and communities, (iii) provide complementary support for agricultural extension, and (iv) plan for effective and sustainable on-farm water management and O&M. The CPS notes the threat of climate change and natural disaster risks for Nepal, and calls for adaptation and risk mitigation to be included in ADB's new investments.

⁶ ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to Nepal for the Water Resources Project Preparatory Facility*. Manila.

Problem Tree for Surface Irrigation



Sector Results Framework (Agriculture and Natural Resources, 2013–2017)

| Country Sector Outcomes | | Country Sector Outputs | | ADB Sector Operations | |
|---|--|---|--|---|--|
| Sector Outcomes with ADB Contribution | Indicators with Targets and Baselines | Sector Outputs with ADB Contribution | Indicators with Incremental Targets | Planned and Ongoing ADB Interventions | Main Outputs Expected from ADB Interventions |
| <p>Increased agricultural production, productivity, and food security</p> <p>Improved water security in the Bagmati River Basin</p> | <p>Agricultural GDP per capita <i>Target (2017): NRs12,660</i> <i>Baseline (2012): NRs9,866</i></p> <p>Cropping intensity <i>Target (2017): 226%</i> <i>Baseline 2012): 198%</i></p> <p>High-value crop production <i>Target (2017): 6.5% pa</i> <i>Baseline (2012): 5.6% pa</i></p> <p>Proportion of population generally food secure <i>Target (2017): 65%</i> <i>Baseline (2010): 58%</i></p> <p>Water availability in the upper Bagmati River Basin during dry season (at Gaighat) <i>Target (2025): 57 lps</i> <i>Baseline (2013): 38 lps</i></p> | <p>Agricultural infrastructure and systems expanded and improved</p> <p>Access to agricultural services increased</p> | <p>Area with year-round irrigation <i>Target (2017): 1.5 m ha</i> <i>Baseline (2012): 1.3 m ha</i></p> <p>All-season rural road network <i>Target (2017): 14,000 km</i> <i>Baseline (2012): 10,200 km</i></p> <p>Area used for commercial crops <i>Target (2017): 929,610 ha</i> <i>Baseline (2012): 822,664 ha</i></p> <p>Percent of rural households covered by agricultural services and programs <i>Target (2017): 17%</i> <i>Baseline (2012): 12%</i></p> | <p>Planned key activity areas Irrigation, drainage, and flood protection (irrigation system management, flood protection) (31% of funding)</p> <p>Water-based natural resource management (water system development and conservation) (29% of funding);</p> <p>Agriculture and rural sector development (rural infrastructure) (40% of funding)</p> <p>Pipeline projects with estimated amount Bagmati River Improvement (\$30 m); Building Climate Resilience in Watersheds in Mountain Eco-regions (\$23.5 m); Community-Managed Irrigated Agriculture (Additional Financing) (\$30 m); Bagmati River Improvement II (\$29 m)</p> <p>Ongoing projects with approved amount Community-Managed Irrigated Agriculture Sector (\$20 m); Community Irrigation (\$26.4 m); Raising Income of Small and Medium Farmers (\$20.1 m); High Mountain Agribusiness and Livelihood Improvement (\$20 m); Decentralized Rural Infrastructure and Livelihood – Additional Financing (\$25 m); Water Resources Project Preparatory Facility (\$11 m)</p> | <p>Planned key activity areas and pipeline projects 35,000 households have access to improved domestic and irrigation water sources</p> <p>Availability of irrigation water during dry season of at least 0.3 lps/ha</p> <p>15-year integrated river basin development master plan for Bagmati prepared</p> <p>85,000 cubic meter storage capacity dam built</p> <p>Ongoing projects 111 irrigation schemes constructed or rehabilitated; 840 km rural roads and 366 rural water supply schemes constructed or rehabilitated; 290 trail bridges constructed; about 13,000 ha land irrigated; \$20 million worth of high-value crops produced per year; 7,500 jobs created; about 7,500 ha under high-value crops (64,500 metric tons worth \$44.5 million with gross margin of \$9.5 million); 200 km new and 60 km upgraded rural roads constructed. Representation of women in executive levels of farmer groups, cooperatives, and water user associations increased to 33%</p> |

ADB = Asian Development Bank, FY = fiscal year, ha = hectare, km = kilometer, m = million, NRs = Nepalese rupees, lps = liters per second, pa = per annum.

Note: Targets have been set according to the government's targets under its Three-Year Plan Approach Paper (FY2014–FY2016).

Sources: Asian Development Bank and government estimates.