



# IRRIGATION SUBSECTOR GUIDANCE NOTE

BUILDING BLOCKS FOR SUSTAINABLE INVESTMENT

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**BUILDING BLOCKS FOR SUSTAINABLE INVESTMENT**

March 2017



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# Abbreviations

CDTA	-	capacity development technical assistance
CPS	-	Country Partnership Strategy
COBP	-	Country Operations Business Plan
DMC	-	developing member countries
DSS	-	decision support system
FAO	-	Food and Agriculture Organization of the United Nations
ISGN	-	Irrigation Subsector Guidance Note
LOS	-	level of service
MASSCOTE	-	Mapping System and Services for Canal operation Techniques
MFF	-	multi-tranche financing facility
MOM	-	management, operation, and maintenance
NAIMO	-	Network of Asian Irrigation Management Organizations
O&M	-	operation and maintenance
PPTA	-	project preparatory technical assistance
RAP	-	rapid appraisal procedure
SDG	-	Sustainable Development Goals
TA	-	technical assistance
WUA	-	water users associations

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# 1. Introduction

## 1.1 Rethinking Irrigation

The United Nations adopted the Sustainable Development Goals (SDGs) in 2015 to “end poverty, protect the planet, and ensure prosperity for all” (Appendix 1). Achieving many of these goals (e.g., zero hunger, no poverty, progress in the fight against climate change) will require greater attention to food production through the irrigation subsector. Goal 6 (sustainable access to clean water and sanitation) has several targets specific to irrigation (increasing water use efficiency and ensuring sustainable withdrawal to address the problem of water scarcity; implementing integrated water resources management at all levels; improving water quality; restoring and improving water-dependent ecosystems; strengthening the participation of local communities in improving water and sanitation management).

The Asian Development Bank (ADB) is committed to achieving the SDGs and to increasing its support for irrigation to improve food security in the region. Consistent with its appreciation of the strategic importance of this subsector, it has developed a suite of water policies including Water for All Policy (2001) and the Water Operational Plan 2011–2020. In February 2015, it released the Guidance Note: Irrigation Subsector Risk Assessment explaining key features of the subsector and providing a framework for mapping its governance risks.

The Second Asian Irrigation Forum, convened by ADB in early 2016,<sup>1</sup> ascribed the subsector’s lower-than-expected performance to limitations in governance, water productivity, innovation, financing, and modernization. The forum also underscored the dichotomy between irrigation investments as instruments of social policy, particularly in ADB’s developing member countries (DMCs), and irrigation as a mechanism for economic development.

The forum led to the realization that a well-thought-out approach—defining and focusing on ADB’s comparative advantages, and involving collaboration and leveraging of development partner expertise—was necessary to improve subsector performance. ADB therefore agreed to prepare an irrigation subsector guidance note (ISGN) for Asia and the Pacific.

ISGN development is supported by the Australian Water Partnership under a memorandum of understanding with ADB. Australia provides unique insight and experience to water resources management and irrigation in water scarce conditions. It

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<sup>1</sup> This forum was held at ADB headquarters in Manila on 20–22 January and its findings were reported to the ADB Board. The first forum, also at ADB, was held from 11 to 13 April 2012.



has significant comparative advantage to share these learnings with the Asian region and provide long term, more strategic support.

The ISGN will guide ADB and its DMCs in defining core areas of support in the irrigation subsector and set the course for country partnership strategy investments in irrigation for lending and nonlending assistance. The latter would center on support for the required irrigation reforms, capacity building, and knowledge and technology transfer.

## 1.2 Pursuing Sustainability

ADB has been working with its DMCs to make the results and benefits of its operations more sustainable. The ADB Development Effectiveness Review 2015 highlighted the efficiency and sustainability constraints on sovereign operations. With ADB's support, the DMCs are considering options like performance-based contracting and dedicated operation and maintenance (O&M) funding to improve the sustainability of infrastructure and accrue long-term benefits.

The ISGN will build on the findings from an ADB evaluation of projects and programs in various sectors (including irrigation subsector), which concludes that while output delivery was mostly being achieved, sustainability was harder to ensure. The evaluation found six factors common to successful projects and missing from others:

- (i) sufficient financing for sustainable O&M;
- (ii) adequate asset management;
- (iii) adequate institutional capacity, and retention of DMC management staff after project completion;
- (iv) appropriate design, good-quality construction, and use of modern technologies;
- (v) strong institutions willing to undertake reforms step by step; and
- (vi) awareness of issues, commitment to change, willingness of government to become the lead change agent, and community involvement.

The assessment of financial and economic sustainability that is central to investment processing assumes that outcomes and output will continue to be delivered over the economic life of a project. In reality, however, the inability of current levels of O&M to sustain project output is an issue that is regularly raised in the context of irrigation investments. Inadequate O&M cannot prevent assets from deteriorating substantially before the end of their projected life, and is considered a major cause of uncertain project outcomes.

## 1.3 Goals for the Irrigation Subsector

ADB's overall goal for irrigation projects is to increase agricultural productivity thereby strengthening regional food security, and optimizing water use amongst various users to promote economic development. Critical elements of this goal are:

- (i) Sharing water resources across users including agriculture, households, energy and the environment to support the achievement of SDGs.
- (ii) Producing more food with less water. Latest estimates suggest that food production in the developing world must double by 2050. By that year, according to ADB's Asian Water Development Outlook 2016, urban and industrial water demand will have increased from the present 20% of total regional demand to 40%. Water use in irrigation (now about 80% of the total) must become more productive, particularly as climate change makes water even less available.
- (iii) Improved production, crop value, and farmer livelihoods. Regional farmers are invariably poor and their small landholdings limit their enterprise options.<sup>2</sup>
- (iv) Sustainable water-dependent ecosystems. These are already degrading and will continue to do so due to water use increases, to the detriment of ecosystem functioning. There will be a loss of biodiversity, and societal values, such as recreation and tourism, will be impaired.
- (v) Minimized conflict from sharing of water resources. Even now, there is conflict within river basins between farmers, water user groups, sectors, and jurisdictions, including states and nations, as water supply diminishes in quantity and quality. Population growth and more intense effects of climate change will exacerbate the situation.

## 1.4 Purpose of the Guidance Note

The ISGN is intended to assist and strengthen the preparation of interventions that will increase food production and security, use water within the resource availability limits, ensure that assets are maintained and remain effective, thereby providing long-term benefits.

The aim is to develop a structured approach to the preparation of irrigation investment that will enable timely intervention where necessary. The resulting investments would be more robust and sustainable. Triggers that prompt project managers to review projects for timely reformulation and strengthening would also be provided. Such an approach would provide much clearer signals to project officers and DMCs regarding the necessary elements of projects.

## 1.5 End Users

The ISGN is mainly for the use of project officers at various stages of the ADB project cycle, in their negotiations with DMCs, and in the preparation of project proposals for lending and nonlending assistance.

Other important users are DMC staff; consultants involved in project preparation, implementation, and review; ADB internal reviewers; and project evaluation management and staff.

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<sup>2</sup> Studies based on the World Census of Agriculture 2000 of the Food and Agriculture Organization of the United Nations (FAO) indicate that landholdings in the Asia and Pacific region are the smallest in the world. Compared with an average landholding of 5.5 hectares for the 114 FAO member countries with available data, landholdings in Asia average only about 1 hectare.

## 2. Drivers and Directions of Change

### 2.1 Stronger, Better, Faster

At the program level, the goal of ADB is “stronger, better, faster”—meaning scaling up lending with more efficient management, better projects in terms of quality, impact and effectiveness, and faster disbursement of funds with projects closing on schedule or earlier.

Investment in irrigation is complex and devising transformative projects is challenging for a number of reasons including (Appendix 2):

- (i) wide range of subprojects that are spread over a large geographic area, often comprising dispersed small activities with low density of capital investment;
- (ii) range of water users and uses, including the environment, basic human needs, fishing, agriculture, industry, and energy;
- (iii) large number of government stakeholders at different levels, and large number of individual water users;
- (iv) diverse social structures and power groupings;
- (v) challenges related to governance, water theft, vandalism, and corruption; and,
- (vi) performance constraints at the farm level such as small landholdings, limited access to capital and technology, and substandard farming skills.

Pressures to meet future food demand of a growing and prospering Asian population, securing water for rapidly growing urban centers and other industry sectors, and improve environmental conditions requires continued engagement in the irrigation subsector.

The targeting of stronger and faster projects, needs to be tempered with the reality of DMC capacity. This may mean taking a more long-term perspective to achieve “better” projects. ADB experience indicates that project effectiveness increases where the project builds progressively on earlier sector investment and where complementary projects, such as building agricultural capacity and associated value chains, are undertaken by ADB or other development partners. Where capacity is found to be limited, greater due diligence and preparation through initial information gathering and preliminary studies is advisable.

In designing projects, it is important to consider the full range of alternative financing modalities and to tailor these to the needs of the project and capacity of the DMC. For example, the following alternatives should be examined:

- (i) Project loans, which focus on more straightforward individual projects but have limited ability to address more complex and innovative requirements.
- (ii) Sector loans, which support a government's sector development plan. Such a plan can cover organizational change, investment, and policy reform—all aimed at making broad improvements in a sector.
- (iii) A multitranche financing facility (MFF), which supports a client's medium- to long-term investment program and allows investment and complexity to increase in step with gains in capacity and understanding. An MFF includes policy and infrastructure investment consistent with the DMC sector road map. The longer time frame also enables more thorough capacity building, to develop wider and more sustainable outcomes, particularly regarding institutional and policy reforms.
- (iv) Policy-based loans, which call for policy and structural reforms. These loans could be untied from infrastructure projects and undertaken over appropriate time frames.

## 2.2 Irrigation Modernization

Irrigation projects proposed by DMCs are typically rehabilitation projects to repair systems that were designed many years ago with no assurance of the appropriateness of their design when first planned. Limited O&M funding results in infrastructure decay and the systems suboptimal performance. Rehabilitation projects tend to deal only with part of a system and do not take the opportunity to systematically upgrade the infrastructure and related management approaches to meet the service needs of farmers by optimizing production and water productivity.

Modernization is variously defined. It is a continuing process that must be driven by the demand and resources of users and requires step-by-step implementation. The Food and Agriculture Organization (FAO) defined modernization as: “a process of technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation schemes combined with institutional reforms, if required, with the objective to improve resource utilization (labour, water, economic, environment) and water delivery service to farms.” The ADB definition, which builds on the FAO definition, is presented in Appendix 3. It presents in more detail the scope and significance of the overall system of water resources management, infrastructure, and operation and maintenance, and states that the real goal of modernization is to optimize production and produce more food and fiber from the existing quantum of water or less.

It is important to recognize the difference between rehabilitating and modernizing a system, and the implications of each of these options. An *irrigation rehabilitation project* returns the level of service (LOS) of the system essentially to the original design. The economic benefits of this investment would need to be assessed carefully as they mostly predate the rehabilitation project. Such projects do not involve reconfiguring the canal network or adopting emerging new technologies such as automation. An *irrigation modernization project*, on the other hand, should significantly increase the LOS for the intended water users and better reflect water availability, cropping, and management flexibility, thus improving agricultural productivity well above the preexisting level. Modernization might also involve closing down parts of the original system (limiting the originally designed command area) if water availability does not meet design expectations. The LOS would then increase for the remaining water users.

The debate over whether a project should be modernized or rehabilitated can unnecessarily distract from the most important goal. This is for the system to deliver a better LOS to the end user. Overall, a modernized system with an appropriate LOS is likely to be much more economically justifiable than a rehabilitated system.

## 2.3 Level of Service: A Modernization Fundamental

The LOS of an irrigation system is critical to the efficient use of water and increasing food production. A well-determined LOS will deliver the allocated water flexibly, reliably, and equitably throughout the entire design command area, according to crop water needs. It will also introduce a degree of water scarcity to encourage farmers to produce more with less.

There is widespread evidence of demand for a good LOS. For example, farmers commonly invest in groundwater development even where it is more expensive than surface water. This allows them to decide the timing of irrigation, the water flow rate, and the amount of irrigation water to be used.

The LOS has six elements. These are critical factors in crop planning and enterprise decision making to prepare for a move to crops that are higher in value with higher input costs. These same elements should also form the basis for government decisions to modernize irrigation:

- (i) seasonal supply volume (quantity, seasonal variability, and quality of water);
- (ii) delivery or service point conditions (channel capacity, offtake flow rate, offtake elevation);
- (iii) scheduling and flexibility of supply (continuous flow, rotation, on-order, on-demand);
- (iv) reliability (control and operation of structures to supply the intended quantity and flow consistently);
- (v) equity (often viewed as “tail-ender” water supply problems, where water is not distributed to the lower end of canals because of insufficient hydraulic control); and
- (vi) cost (normally a trade-off versus the other elements, determining the willingness of farmers and the government to invest).

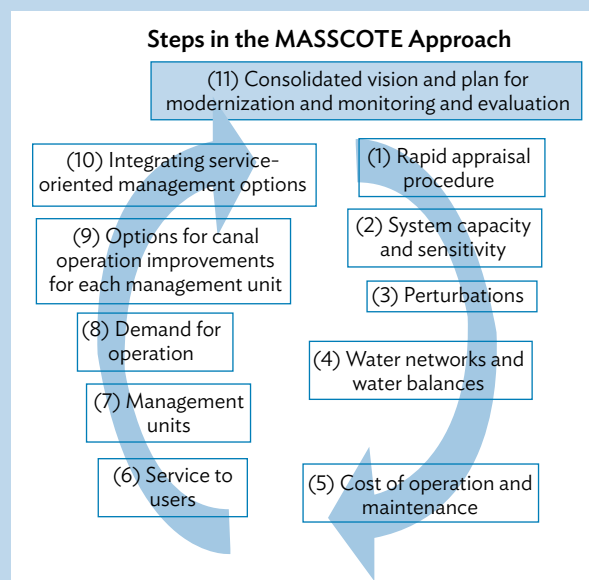
The LOS concept applies at the offtake points within the irrigation system. The number of offtake levels will depend on the configuration of the system. For example, LOS is relevant from the main canal to distributaries, through successive levels, until water is delivered to the individual irrigator.

The LOS created by the infrastructure, management systems, and operational policies *determines* the level of ‘crop per drop’ or ‘cash per splash’ that is possible. The LOS

assessment should be included early in project planning and a MASSCOTE<sup>3</sup> assessment is a good basis for doing this (see box). Often, the farm production benefits expected from the project will not be possible unless the LOS provided enables that level of production and agricultural support services are available to support improved agronomic practices. A clear understanding of the expected LOS enhancement will determine the project focus—rehabilitation or modernization.

### Case Study of FAO's MASSCOTE Procedure

The Mapping System and Services for Canal Operation Techniques (MASSCOTE) procedure is a step-by-step methodology for water engineering professionals, managers, and practitioners involved in modernizing medium- to large-scale canal irrigation systems. The approach is shown in the accompanying diagram. The rapid appraisal procedure (RAP) is the first step—a valuable one—in understanding and assessing the irrigation system with irrigation system managers, leading to a comprehensive modernization plan.



The Sunsari Morang Irrigation System in Nepal, for example, is the country's largest irrigation system, with a command area of 100,000 hectares and a main channel 53 kilometers (km) long with a discharge of 60 cubic meters per second ( $\text{m}^3/\text{sec}$ ). The system was originally designed for supplementary irrigation of paddy rice fields during the monsoon season (kharif). However, year-round demand for irrigation water has steadily increased.

Project authorities identified a major physical constraint: the flow of the Koshi River in winter and spring could provide only 15–20  $\text{m}^3/\text{s}$  (or even as low as 5  $\text{m}^3/\text{s}$ ). In low-flow conditions, with the existing control strategy and infrastructure, it was very difficult to supply irrigation water equitably to different areas of the project. Historically, tail-enders suffered the most from water shortages. Many received no irrigation water from the canal system. As a result, conjunctive use of groundwater and low-lift pumping of drainage water, particularly toward the tail end of the system, was rising. There was also evidence of a lack of coordination between farmers and project engineers, indicated by the planting of rainfed crops adjacent to the canals, and spring paddy at the end of watercourses.

*continued on next page*

<sup>3</sup> FAO. 2007. Modernising Irrigation Management: The MASSCOTE Approach—Mapping System and Services for Canal Operation Techniques. *FAO Irrigation and Drainage Paper 63*. p. 238.

*Box continued*

According to the MASSCOTE RAP, the system's LOS had the following characteristics:

- seasonally variable water supplies, which may decrease by 50%–70% in the winter and spring (15–60 m<sup>3</sup>/s);
- less-than-accurate control of flow into secondary and tertiary canals associated with severe fluctuations in water level;
- rotation schedules that are not rigorously enforced;
- institutionally weak water users associations with responsibility for operation and maintenance of substantial portions of the project, but having only minimal budgets;
- severe inequity (tail-ender problems);
- low collection rates for an irrigation service fee that is set well below actual costs; and
- phased implementation rehabilitation efforts, which have resulted in a mixture of different water control strategies and hardware (fully gated versus proportional flow).

Source: Adapted from FAO. 2007. Modernising Irrigation Management: The MASSCOTE Approach—Mapping System and Services for Canal Operation Techniques. *FAO Irrigation and Drainage Paper 63*, p. 39.

## 2.4 A More Interventionist Approach to Project Preparation

In Asia and the Pacific, agricultural productivity continues to be low compared with international standards, and underinvestment in O&M leads to a build–neglect–rehabilitate–neglect investment cycle. Investment in irrigation projects is fraught with a risk of future underperformance without sufficient attention to O&M requirements.

ADB's strong safeguard assessment requirements ensure that social and environmental needs are explicitly assessed and critically analyzed during the short-term construction phase of the project. However, a longer-term strategic assessment of the risk and impact of reduced water flow or quality on the environment may be rarely undertaken. More importantly, the basics of infrastructure design and supporting management systems, do not appear to undergo commensurate or adequate due diligence or scrutiny.

DMCs often do not see the importance of adopting more comprehensive and systematic approaches beyond the basic repair of the existing system. This leads to projects that lack basic water resources management systems or infrastructure that is constructed without measures to ensure that project benefits are achieved. As a result, such projects may not yield the potential benefits.

## 2.5 Innovation and New Technologies

ADB aspires to introduce innovation and new technologies in its projects to improve project design and performance. If introduced appropriately, emerging technologies deployed for irrigation control in developed countries will enable developing countries to leapfrog the older manual technologies. But the capacity to do this will vary from country to country. The issue must be approached with care, as it may adversely affect the livelihoods of many water users.

Some technologies (e.g., laser land leveling) are well established in developed countries and could be introduced with little risk in developing countries. However, other technologies, like drip irrigation, canal flow measurement, and automation, which could greatly reduce interference, poor management, and governance of the system, need more careful consideration of their feasibility, given the risks involved in their introduction, and should be tested before they are fully implemented.

There are also emerging technologies that lessen the dependence on operators and local management with limited skills, capacity, and motivation. One example is remote sensing to measure crop water use and crop water productivity and to calculate water balance. Information technology and the smartphone revolution will also enable remote measurement, automation, scheduling, monitoring, and control of water delivery and water use efficiency.

One group of countries (e.g., the People's Republic of China, India, Indonesia) generally has more than sufficient financial capacity to consider, with guidance in some cases, the adaptation of new and innovative approaches to suit their circumstances. Another group (e.g., Afghanistan, the Lao People's Democratic Republic, Myanmar) has comparatively less capacity and limited access to finance. For the countries in this second group in particular, the focus should be on the basics and on the provision of technical assistance and capacity building.

## 2.6 'Crop per Drop' or 'Cash per Splash': The True Imperative

The goal of increasing agricultural production per unit of water applied is expressed in the catchphrase "more crop per drop." This phrase, however, can be misleading for nonspecialists as well as for governments as it suggests the intent to produce more at all costs and dilutes the emphasis on farmers, their decision making and profitability, and the economic justification for projects.

The performance of the sector revolves around the farmer, and this fact should be an integral factor in project preparation. For farmers, climatic and financial risk, labor demand, and, critically, the prospect of good profits are of overriding importance. If the profits promise to be good and the risks are acceptable, farmers will respond with further production, provided they have the skills and resources. To bring this imperative



and understanding to the attention of project officers and governments, an additional catchphrase that captures the farmers' perspective—'cash per splash'—is needed.

Chasing 'crop per drop' and water savings from major capital investment in irrigation infrastructure is often done to assign "water savings" to new water users. In many cases, these "water savings" are illusory, as the water was previously used by downstream or groundwater users. These users may face adverse impacts as a consequence of the modernization works, while the overall river basin "water use efficiency"<sup>4</sup> remains unchanged.

It is suggested, given Australia's experience over many years, that the sector would benefit from redirecting its focus from traditional water use efficiency and yield per cubic meter to a system-based approach that gives the farmer more options in producing more. Useful performance indicators for this purpose would be farmer profitability, crop water productivity, and water system distribution efficiency, and the fundamental determinant of the success of this approach, as well as of irrigation sector modernization, would be the "level of service."

## 2.7 Scope and Risks of Changing Farm Production Systems

To increase agricultural production, change must occur at the farm production level. Initially such change increases risks to farmers with their small landholdings and limited capital. These relate to financing, market and input prices, management skills, capacity to adopt new technologies, and seasonal water availability and climate risk. If such risks are not addressed, the scope for increasing 'crop per drop' or 'cash per splash' is likely to be limited.

Failure to deliver the intended LOS is another major risk for farmers and the success of investment projects. Farmers are more likely to change or otherwise improve their farming systems if they are confident that the LOS is adequate and sustainable. This concern must be considered in project design.

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<sup>4</sup> Water use efficiency may involve measures for the river basin (water consumed/basin water resource, %); the irrigation system (water released from the reservoir or canal head/water reaching the field, %); the field irrigated (water delivered to the field/water consumed by the crop, %); crop productivity (crop production per unit of water delivered to the field or system, kg/m<sup>3</sup>); or economic crop productivity (economic value of crop production per unit of water delivered to the field or system \$/m<sup>3</sup>). Land & Water Australia. 1999. *Determining a Framework, Terms and Definitions for Water Use Efficiency in Irrigation*. Prepared by Barrett Purcell and Associates for the National Program for Irrigation Research and Development, Australia. p. 26

## 2.8 Factors Influencing Decisions to Use Water More Efficiently

In many countries in Asia and the Pacific, farmers are encouraged or required to grow certain crop types like paddy rice, for national food security. This requirement usually limits economic productivity potential and the extent to which farmers can improve their livelihoods. The LOS for such crops (e.g., paddy) is mostly lower and the basic water supply system therefore costs less to build. But the system will have limited flexibility to produce higher-value crops in the future. Growing lower-value crops involves irrigation methods that are more wasteful of water. This is a critical point.

The experience of many countries shows that certain situations are conducive to the adoption of technologies that lead to water savings or more efficient water use. The most effective of these is water scarcity, introduced by the government, by informal water markets, or by drought. This and other water efficiency measures are listed below, in descending order of effectiveness.

- (i) Water scarcity is introduced by upstream users as they increase their water use, by governments reducing water allocations, or by longer-term drought. A short, one-off drought often induces farmers and the government to adopt emergency support measures, which are not sustained in the longer term.
- (ii) Governments or industries invest in upgrading the irrigation infrastructure. Part of the allocated water is diverted to a new irrigation area or for urban or industrial use, or is left in-stream to protect the environment. Such practices are common in both developed and developing countries. However, they come with the risk that the real savings may not be as described or may be far below the amount of water acquired. For this reason, a strong water balance and system of water entitlements and their administration is required before such transfers occur.
- (iii) Subsidies are paid to persuade farmers to adopt better technologies, use less water, or produce more.
- (iv) New technologies that also save labor are often adopted as they enable farmers and their businesses to grow or to source off-farm income. Examples of these technologies are laser grading and drip or sprinkler irrigation. These drastically reduce the time required to operate conventional surface irrigation methods (flood and furrow irrigation), whilst promoting increased production as a result of less waterlogging and more timely application.
- (v) Farmers are granted landholdings of sufficient size to allow them to increase their irrigated area and more efficient water use. As an adjunct to this measure, water markets can be developed to enable the transfer of water to areas where there is water shortage. However, this requires a strong water resource administration system.
- (vi) Farmers can intensify cropping or grow higher-value crops with the water saved. Additional incentives, like subsidies, are usually needed to implement this measure.

- (vii) Farmers can get better crop yields or quality through better water management. Again, adoption will require additional incentives.
- (viii) Farmers can reduce their water charges and save on pumping and storage costs. The projected savings are usually insufficient to drive change without additional incentives, unless costs increase to a point where growing a low-value crop is clearly uneconomic. Importantly, water pricing has limited capacity to drive efficiency improvements in monocropping except where there are gross water use inefficiencies, such as water flowing continuously through a paddy field. Raising water fees can induce a move from low-value to higher-value crops. This leads to benefits from more efficient irrigation methods and the resulting productivity improvements. Such a transition involves some political and financial risk.

## 2.9 Project Sustainability and Effectiveness

Project scoping should make detailed assessment of DMC systems and its capacity to modernize and manage its irrigation systems. The approach to determining the complexity and scale of the modernization should be flexible and should take local circumstances into account.

Some countries have greater capacity to adopt stronger and more ambitious water, irrigation management, and water administration systems. Generally these countries are also wealthier and can self-finance modernization projects. ADB can provide real value added in these circumstances by strengthening reform in water and irrigation management. Indeed, some countries like the People's Republic of China, value this finance plus element of a development partner.

For countries on the lower end of the development curve, a more modest and “no-regrets” approach should be considered. This would involve building the basic essentials for irrigation system management, operation, and maintenance while avoiding detrimental impact on third parties and the environment.

Projects where governance is demonstrably weak i.e.—there is little control, measurement, and enforcement of water allocations, or infrastructure vandalism and water theft are common—, should give pause to planners and invite further negotiation with the DMC regarding the pathway to rehabilitation or modernization. Similarly, caution and due diligence must be exercised before more complex water policies are implemented. There is often interest in water trading and water markets as a way of boosting the economic performance of irrigation. This must be based on a rigorous, well-administered, and well-monitored system of water allocations. In Australia, introducing water trading on a large scale had unintended impact on water availability and allocations despite the country's mature and tested water allocation system at the time.

Sustainability should be planned and built into projects. ADB project assessments have found that operation and maintenance, commonly assumed to be satisfactory, is not undertaken. Project life is much shorter than intended and needed to justify investment.

The loan agreement should explicitly provide for management, operation, and maintenance (MOM), including its funding.

The allocation of water, consistent with river basin water supply, irrigation water availability, and overall water balance, must be clarified before projects proceed. The treatment of unauthorized water users should also be well defined (e.g., provide allocations while making corresponding reductions in existing authorized user allocations). Similarly “water savings” must be assured and real, and not involve an unintended transfer of water from existing to new users.

For projects to be sustainable, water users must be involved in irrigation planning and system O&M, through water user associations or similar groups. This course of action appears to have had mixed success, for a number of reasons. But without an irrigation system that controls and measures water deliveries to individual water users, it is difficult to find an alternative model for the local sharing of water and the maintenance of lower-level canals. Irrigation system management at this level, including water sharing and MOM must be explicitly provided for during project preparation.

### 3. The ADB Project Cycle

The ADB project cycle is seen as an established mechanism for introducing interventions to contribute to better-prepared projects. Each stage of the project cycle offers control points at which quality improvements could be made and capacity for more rapid disbursement enhanced.

While this ISGN does not explicitly address the issue of ‘stronger’ projects, there is ample scope and a range of options for targeting such projects, such as focusing on the management and development of a river basin and addressing several projects or projects of a larger scale (e.g., reservoir construction and irrigation development) within the same loan. Larger projects come with more complexity and risk, including the involvement of various sectors.

Indicators of the building blocks of good practice (Section 4) would be evaluated at relevant stages of the project cycle, with each indicator becoming progressively more detailed as the project cycle proceeds, as shown in Table 1.

**Table 1: ADB Project Cycle and Points of Intervention to Improve Project Quality and Timeliness**

Stage of ADB Project Cycle	Better Quality	Faster	Application of Building Blocks	Time Frame
Country Partnership Strategy (CPS)			✓	1–2 years
Projects screened and any necessary studies and activities undertaken to ensure readiness			✓	Part of above
Country Operations Business Plan (COBP)			✓	Annual update
ADB Project Concept Paper			✓	6 months
Additional/Parallel studies to enable proper PPTA			✓	1 year
Project Preparation Technical Assistance (PPTA)			✓	6 months
Loan Processing			✓	6 months–1 year
Loan Approval				3–6 months
Loan Implementation				7–10 years
Completion Report				Within 1 year

Source: ADB.

As part of the ISGN approach, very specific questions would be asked at each stage of the project cycle and the answers would be verified against specific evidence. At successive stages, the specificity and depth of the evidence would increase. Early identification of likely limitations that could weaken project preparation, like lack of hydrologic and water balance data or of appropriate management institutions, would mean that additional actions can be taken early to enable later stages of preparation to proceed more smoothly.

Ultimately, the assessment could require project officers and DMCs to provide more detail from the government or secure its agreement before loan processing.

Table 2 shows the ADB project cycle and possible interventions.

**Table 2: ADB Project Cycle and Possible Interventions**

ADB Project Cycle Stage	Possible Intervention
<p><b>Country Partnership Strategy (CPS)</b> Includes thematic and sector analyses and assessment studies</p> <p><b>Time frame:</b> 1 year (max. 2 years)</p> <p><b>Potential for intervention to improve project quality:</b> Significant time for information gathering and assessment; a <b>critical stage</b> to ensure that projects placed in the COBP have high readiness and likelihood of success</p>	<p><b>Purpose:</b> Make preliminary (high-level) assessment of water sector conditions (policy, institutions, data, etc.) to guide the content and investigations for later events in the cycle, especially the COBP. This stage and the period before the COBP are critical to ensuring that only the best and most ready projects are included.</p> <p>On the basis of the building blocks, assess conditions and undertake critical preassessments of water sector conditions. Assess and ensure readiness of proposed projects, and assess later studies before inclusion in the COBP.</p> <p>For example:</p> <ul style="list-style-type: none"> <li>(i) Is there a water resources inventory and assessment on a river basin scale and does it assure water availability for the project?</li> <li>(ii) Does the project have transboundary implications?</li> <li>(iii) Are institutions appropriate (independent authority–state-owned enterprise for bulk water and irrigation system management) and receptive to possible policy reform and do they have the capacity and systems to manage water resources from headworks to field?</li> <li>(iv) Do institutions have systems in place for water allocation and equitable water sharing?</li> <li>(v) Are systems in place for MOM?</li> <li>(vi) Are data available to enable proper project design?</li> <li>(vii) Are farmers likely to have the capacity to translate improvements in water supply into increased production?</li> <li>(viii) Have representative MASSCOTE studies been undertaken to assess the type and extent of project required?</li> <li>(ix) Is the country willing to absorb more complex projects, innovations, and new technologies, and does it have the capacity to do so?</li> </ul>

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Table 2 continued

ADB Project Cycle Stage	Possible Intervention
<p><b>Country Operations Business Plan (COBP)</b> Three-year rolling pipelines and the necessary resources (lending, non lending) leads to:</p> <ul style="list-style-type: none"> <li>• Project Concept Note</li> <li>• PPTA guidance</li> </ul> <p><b>Time frame:</b> Updated yearly</p> <p><b>Potential for intervention to improve project quality:</b> Limited time and scope</p>	<p><b>Purpose:</b> For projects in the COBP, make a high-level assessment of the basic status of water sector capacity in the country/project and the existing information that would support project design and the appropriate financing modality.</p> <p>Information here would be taken from the CPS, with additional project-specific information guided by the <i>building blocks</i>, such as:</p> <ol style="list-style-type: none"> <li>(i) Have basic studies been done to support project preparation (e.g., river basin water resource assessments, MASSCOTE studies, water resource accounting, detailed project reports)?</li> <li>(ii) Have the appropriate financing modalities been included?</li> </ol> <p>If these <i>obligatory</i> studies have not been done, they would be prepared, gaps would be filled in parallel with concept note preparation, and more detailed and specific terms of reference for PPTAs would be provided.</p>
<p><b>Concept Paper</b> <b>Time frame:</b> 6 months</p> <p><b>Potential for intervention to improve project quality:</b> Moderate time and scope</p> <p><b>Decision at completion:</b> Identification of critical information needs for satisfactory project design; flagging of projects that should be delayed and strengthened</p>	<p><b>Purpose:</b> Building on the above, ensure that the concept paper reports on critical questions from the building blocks to enable assessment of project readiness.</p> <ol style="list-style-type: none"> <li>(i) Determine the need for assessments that should precede the PPTA so that it leads to good project design.</li> <li>(ii) Gather additional data and information through additional studies for the PPTA terms of reference so that the PPTA can proceed efficiently and concentrate on the key issues and needs.</li> </ol>
<p><b>Parallel/Additional Studies</b> <b>Time frame:</b> 6 months</p> <p><b>Potential for intervention to improve project quality:</b> Significant time and scope</p> <p><b>Decision at completion:</b> Whether to proceed or continue with further studies and capacity building</p>	<p><b>Purpose:</b> Ensure that there is adequate information and DMC readiness so that the PPTA can proceed smoothly and effectively.</p> <ol style="list-style-type: none"> <li>(i) Undertake final information gathering and studies to enable a detailed PPTA and loan processing.</li> <li>(ii) Undertake capacity building of DMC if necessary to ensure that it understands the important elements of integrated water resources management for irrigation projects and the reforms required (e.g., water sharing, levels of service, MOM, financing).</li> </ol>

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Table 2 continued

ADB Project Cycle Stage	Possible Intervention
<p><b>Project Preparation Technical Assistance (PPTA)</b></p> <p><b>Time frame:</b> 6 months</p> <p><b>Potential for Intervention to improve project quality:</b> Significant time and important scope for a strong and well-designed project</p> <p><b>Decision at completion:</b> Whether to proceed or to put project on hold until satisfactory information is provided for loan processing</p>	<p><b>Purpose:</b> Make and finalize all detailed assessments, project design, and feasibility and safeguard studies to enable project specification for loan processing.</p> <p>To improve the likelihood of moving into implementation rapidly from loan effectiveness,</p> <ul style="list-style-type: none"> <li>(i) assess the readiness of the agency to move into implementation;</li> <li>(ii) prepare various TORs and training so that implementation can begin once the loan takes effect; and</li> <li>(iii) provide explanation and preliminary training to help the counterpart agency understand ADB procedures.</li> </ul>
<p><b>Loan Processing</b></p> <p><b>Time frame:</b> 6 months (up to 1 year)</p> <p><b>Potential for intervention to improve project quality:</b> Moderate time and scope</p>	<p><b>Purpose:</b> Make a final, high-level assessment of the project, and possibly gather further information, to ensure that the project has the necessary ingredients to succeed.</p> <p>Undertake initial capacity building and assistance to enable advanced procurement and other project mobilization actions to be taken.</p>
<p><b>Loan Approval</b></p> <p><b>Time frame:</b> 3–6 months</p> <p><b>Potential for intervention to improve project quality:</b> Nil</p>	<p><b>Purpose:</b> Work with the country to improve understanding and timely implementation of ADB administrative procedures.</p> <p>Ensure timely recruitment of consultants and procurement of works.</p>

CPS = Country Partnership Strategy, COBP = Country Operations Business Plan, DMC = developing member country, MASSCOTE = Mapping System and Services for Canal Operation Techniques, MOM = management, operation, and maintenance, PPTA = project preparatory, TOR = terms of reference.

Source: ADB.



## 4. Pillars and Building Blocks of Effective Irrigation Projects

### 4.1 Framework

Improving irrigation performance is largely a governance issue. It involves a hierarchy of water managers, and the capacity and approaches used at the different stages is targeted at strengthening project preparation and implementation. The proposed framework has three primary elements on which effective irrigation sector projects are built.

- (i) **Pillars of good water resources management.** This rests on five institutional pillars which define the core responsibilities of different public and private water managers in the water sector. These are used for institutional assessments, management and capacity building. This is regarded as a valuable structure. It should assist project officers and consultants as it focuses on the responsible agencies and their role and capacity to deliver effective projects.

The five pillars are:

- a. government water policy and institutions;
  - b. the water resource manager, usually the technical function within the water resources department (for this framework, this includes river basin organizations and the bulk water supply function that operates reservoirs and river infrastructure and protects the river environment);
  - c. the irrigation (and drainage) system manager responsible for managing the primary or secondary canal system and water supply services to farmers;
  - d. the community or farm irrigation system manager, usually a farmer-based water user association responsible for tertiary canal systems; and
  - e. the farm production system, which comprises individual farmer enterprises and their households.
- (ii) **Building blocks for good irrigation outcomes.** Studies of the water and irrigation sector over many years have proposed key ingredients for a well-performing sector. A common approach<sup>5</sup> to assessing performance evaluates status from the

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<sup>5</sup> For example, World Bank. 2006. *Integrated River Basin Management: From Concepts to Good Practice*. A series of 15 Briefing Notes. Washington, DC.

perspective of the institutions and policies; data, information, and decision support systems; plans, strategies, and operating systems; participation; and financing.

A review was made of ADB policy and project documents and broad based consultations with ADB staff (operations and non operational departments). This was used to identify the evidence and issues leading to underperforming projects and then to develop specific and key building blocks that should lead to improved project outcomes (Table 3).

- (iii) **Key indicators.** For each building block there are a range of key questions and practical indicators for intervention along the ADB project cycle. This evidence-based approach would enable intervention at appropriate stages of project preparation. The indicators would be further developed to provide a checklist at different stages of the ADB project cycle. They must therefore be tangible and easily verified.

ADB project governance is critical to project preparation and outcomes. However, it is not included explicitly in this framework. A number of issues relevant to the matter, such as maintaining a supply chain of experienced staff and consultants, building DMC capacity for program implementation, and drawing up best-practice guidelines<sup>6</sup> for the project, were identified during the issues assessment phase. These issues are addressed in later recommendations.

## 4.2 Key Questions and Indicators of Project Readiness

Key questions and indicators of project readiness were framed for each of the five pillars. The scope of key questions and indicators for assessing readiness for each pillar is shown in Table 3. Some of these questions will have higher priority and some will be more easily verified and fed into a checklist.

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<sup>6</sup> The Food and Agriculture Organization has released a series of irrigation and drainage papers, although most are fairly old and would benefit from updating and, in some cases, from a stronger management and purpose orientation.

Table 3: Potential Key Questions and Indicators for Assessing Readiness

<b>Pillar 1: Government Water Policy Institutions</b>	<b>Pillar 2: The Water Resources Manager</b>	<b>Pillar 3: The Irrigation System Manager</b>	<b>Pillar 4: The Community/ Farm Irrigation System Manager (WUA)</b>	<b>Pillar 5: The Farm Production Unit</b>
<b>Goal:</b> Government to have policies and capacity for sustainable water resources management and to deliver project goals over the long term	<b>Goal:</b> Government to control water use within the resource availability, and to share and deliver water to sectoral users (e.g., urban areas, irrigation, industry, environment) more equitably/reliably	<b>Goal:</b> Realistic and appropriate rehabilitation/modernization, based on agreed LOS with a long-term functioning system delivering water allocations to farmer groups	<b>Goal:</b> Local water supply system designed with LOS fit for purpose with agreed water sharing and system operation arrangements	<b>Goal:</b> Increased food production and household income
<b>1.1 Relevant Policy and Laws</b>	<b>2.1 Water Resources Data</b>	<b>3.1 Levels of Service and Water Sharing to WUAs</b>	<b>4.1 Level of Service to Individual Farmers</b>	<b>5.1 Crop Information</b>
Are there	Is there a water resources information system comprising	Are there service levels for supply to WUAs that specify	Are the service levels within the WUAs clear and recorded, and do the recorded data cover	Is there information on
(i) comprehensive water and land management policies and laws; and	(i) hydrometeorological network;	(i) water shares and reliability, up to the tail end of canals;	(i) water shares and reliability, up to the tail end of networks;	(i) cropping patterns and area;
(ii) appropriate and suitably empowered organizations?	(ii) water diversion measurement; groundwater levels and use;	(ii) supply rate, continuity, and reliability;	(ii) supply rate, continuity, and reliability;	(ii) yields (kg/ha; kg/m <sup>2</sup> ) vs potential and scope for increase;
	(iii) remote sensing of water consumption and crop productivity?	(iii) supply scheduling (rotational frequency or continuity);	(iii) supply scheduling (rotational frequency or continuity);	(iii) agricultural support services provided by government or private sector; and
	(iv) water quality; and	(iv) cost of supply; and	(iv) cost of operation and maintenance; and	(iv) projections of change in the agriculture sector that will affect water demand and services?
	(v) remote sensing of water consumption and crop productivity?	(v) reporting water supply throughout the system?	(v) deliveries throughout the system?	

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Table 3: continued

<p><b>Pillar 1: Government Water Policy Institutions</b></p> <p><b>Goal:</b> Government to have policies and capacity for sustainable water resources management and to deliver project goals over the long term</p>	<p><b>Pillar 2: The Water Resources Manager</b></p> <p><b>Goal:</b> Government to control water use within the resource availability, and to share and deliver water to sectoral users (e.g., urban areas, irrigation, industry, environment) more equitably/reliably</p>	<p><b>Pillar 3: The Irrigation System Manager</b></p> <p><b>Goal:</b> Realistic and appropriate rehabilitation/modernization, based on agreed LOS with a long-term functioning system delivering water allocations to farmer groups</p>	<p><b>Pillar 4: The Community/ Farm Irrigation System Manager (WUA)</b></p> <p><b>Goal:</b> Local water supply system designed with LOS fit for purpose with agreed water sharing and system operation arrangements</p>	<p><b>Pillar 5: The Farm Production Unit</b></p> <p><b>Goal:</b> Increased food production and household income</p>
<p><b>1.2 Water Management Institutions</b></p> <p>Is there an appropriate suite of water management organizations, including the following:</p> <ul style="list-style-type: none"> <li>(i) cross-sectoral apex water organization;</li> <li>(ii) civil society organization;</li> <li>(iii) water resource manager;</li> <li>(iv) bulk water supply manager;</li> <li>(v) irrigation system manager; and</li> <li>(vi) community/farmer water users?</li> </ul> <p>What is their capacity?</p>	<p><b>2.2 River Basin Water Balance</b></p> <p>For the project river basin(s), is there an assessment of</p> <ul style="list-style-type: none"> <li>(i) water availability;</li> <li>(ii) reservoir inflows and outflows;</li> <li>(iii) water users, and current and future demand, including climate change and variability;</li> <li>(iv) security/reliability of supply; and</li> <li>(v) whether project water savings are real or illusory?</li> </ul>	<p><b>3.2 The Planned Modernization</b></p> <p>Is there</p> <ul style="list-style-type: none"> <li>(i) a MASSCOTE study<sup>a</sup>; and</li> <li>(ii) a detailed, comprehensive project report for the modernization (in accordance with MASSCOTE) with QA?</li> </ul>	<p><b>4.2 The Planned Modernization</b></p> <p>Is there</p> <ul style="list-style-type: none"> <li>(i) a MASSCOTE study for works at this level; and</li> <li>(ii) a detailed project report that addresses needs at this level?</li> </ul>	<p><b>5.2 Irrigation</b></p> <p>Are there assessments of</p> <ul style="list-style-type: none"> <li>(i) technology type and performance;</li> <li>(ii) water use productivity;</li> <li>(iii) drainage systems;</li> <li>(iv) salinity/waterlogging; and</li> <li>(v) projections and feasibility of change?</li> </ul>

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Table 3: continued

<p><b>Pillar 1: Government Water Policy Institutions</b></p> <p><b>Goal:</b> Government to have policies and capacity for sustainable water resources management and to deliver project goals over the long term</p>	<p><b>Pillar 2: The Water Resources Manager</b></p> <p><b>Goal:</b> Government to control water use within the resource availability, and to share and deliver water to sectoral users (e.g., urban areas, irrigation, industry, environment) more equitably/reliably</p>	<p><b>Pillar 3: The Irrigation System Manager</b></p> <p><b>Goal:</b> Realistic and appropriate rehabilitation/modernization, based on agreed LOS with a long-term functioning system delivering water allocations to farmer groups</p>	<p><b>Pillar 4: The Community/Farm Irrigation System Manager (WUA)</b></p> <p><b>Goal:</b> Local water supply system designed with LOS fit for purpose with agreed water sharing and system operation arrangements</p>	<p><b>Pillar 5: The Farm Production Unit</b></p> <p><b>Goal:</b> Increased food production and household income</p>
<p><b>1.3 Readiness for Reform and Innovation</b></p> <p>Is the government seeking to strengthen its water and irrigation sector and to move beyond the build-degrade-rebuild paradigm? Is there capacity and support for introducing and managing innovative approaches and technologies?</p>	<p><b>2.3 Water Sharing and Allocation to Irrigation System Offtakers and Other Users</b></p> <p>Is there</p> <ul style="list-style-type: none"> <li>(i) a DSS system for making equitable annual water allocation;</li> <li>(ii) a DSS system for scheduling water releases according to demand; and</li> <li>(iii) a register of water users, with accurate measurements and records of water supplied to those users according to their allocation?</li> </ul>	<p><b>3.3 Management, Operation, and Maintenance</b></p> <p>Is there</p> <ul style="list-style-type: none"> <li>(i) a water sharing and allocation plan/method;</li> <li>(ii) accurate measurement and recording of deliveries to WUAs consistent with allocation plan and to the tail end</li> <li>(iii) an asset database, a management plan, and processes for their update and use;</li> <li>(iv) an O&amp;M financing arrangement; and</li> <li>(v) a ring-fenced corporate organization responsible for irrigation water delivery and infrastructure MOM?</li> </ul>	<p><b>4.3 Management, Operation, and Maintenance</b></p> <p>Are/Is there</p> <ul style="list-style-type: none"> <li>(i) formal WUA organizations (charter, LOS, etc.);</li> <li>(ii) water-sharing plans;</li> <li>(iii) an asset management approach;</li> <li>(iv) O&amp;M financing; and</li> <li>(v) reporting of water supply to individual fields/farmers throughout the WUA area?</li> </ul>	<p><b>5.3 Agricultural Strengthening</b></p> <p>Do approaches to strengthening agricultural productivity and profitability adequately address</p> <ul style="list-style-type: none"> <li>(i) agronomic skills;</li> <li>(ii) agricultural business management capacity;</li> <li>(iii) access to finance, crop insurance, labor, etc.;</li> <li>(iv) farmer ability to respond to markets and their demand; and</li> <li>(v) postharvest approaches to preventing spoilage and loss, and to gaining access to markets?</li> </ul>

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Table 3. continued

<b>Pillar 1: Government Water Policy Institutions</b>	<b>Pillar 2: The Water Resources Manager</b>	<b>Pillar 3: The Irrigation System Manager</b>	<b>Pillar 4: The Community/Farm Irrigation System Manager (WUA)</b>	<b>Pillar 5: The Farm Production Unit</b>
<p><b>Goal:</b> Government to have policies and capacity for sustainable water resources management and to deliver project goals over the long term</p>	<p><b>Goal:</b> Government to control water use within the resource availability, and to share and deliver water to sectoral users (e.g. urban areas, irrigation, industry, environment) more equitably/reliably</p>	<p><b>Goal:</b> Realistic and appropriate rehabilitation/modernization, based on agreed LOS with a long-term functioning system delivering water allocations to farmer groups</p>	<p><b>Goal:</b> Local water supply system designed with LOS fit for purpose with agreed water sharing and system operation arrangements</p>	<p><b>Goal:</b> Increased food production and household income</p>
<p><b>1.4 Financing</b></p>	<p><b>2.4 Management, O&amp;M</b></p>	<p><b>3.4 Water User Consultation by the Irrigation System Manager</b></p>	<p><b>4.4 WUA and Farmer Participation</b></p>	<p><b>5.4 Socioeconomic</b></p>
<p>Is government financing in place to ensure a sustainable water and irrigation management sector, including O&amp;M financing? This should include financing from the project loan if the government has no other definite commitment or mechanism.</p>	<p>Are/Is there</p> <ul style="list-style-type: none"> <li>(i) water sharing entitlements/methods;</li> <li>(ii) accurate measurement and recording of deliveries to bulk water users, consistent with the allocation plan;</li> <li>(iii) an asset database and asset management plan, including reservoirs, river regulators, oftakes, riverbanks, and riverbeds;</li> <li>(iv) a ring-fenced corporate (government-owned) organization responsible for bulk water delivery and reservoir and river structure MOM; and</li> <li>(v) consultation with the next level (bulk water) of water users regarding levels of service, performance, fees, etc.?</li> </ul>	<p>Is there evidence of effective consultation and involvement of water users in deciding water allocations and asset management (e.g. by water user federations)?</p>	<p>Are/Is there</p> <ul style="list-style-type: none"> <li>(i) established and effective WUAs in the irrigation command area; and</li> <li>(ii) an established WUA mandate and procedures?</li> </ul> <p>Are farmers satisfied with WUA arrangements and performance?</p> <p>Does the irrigation manager consider the WUAs effective?</p>	<p>This includes normal project assessments and safeguard assessments.</p> <p>In addition: What changes in incomes and rural demographics are likely over the life of the project?</p>

<sup>a</sup> The FAO MASSCOTE approach is a systematic approach involving rapid assessment of irrigation systems to better plan modernization. The assessment covers the irrigation network, water balance, service levels, operation and maintenance, options for operational improvements, and cost-effective modernization planning.

WUA = water users associations; LOS = levels of service; O & M = operation and maintenance; MOM = management, operation and maintenance; DSS = decision support system. Source: ADB.

## 5. Priority Actions and Building Block Indicators for Project Preparedness: ADB Water and Irrigation Sector Project Policy

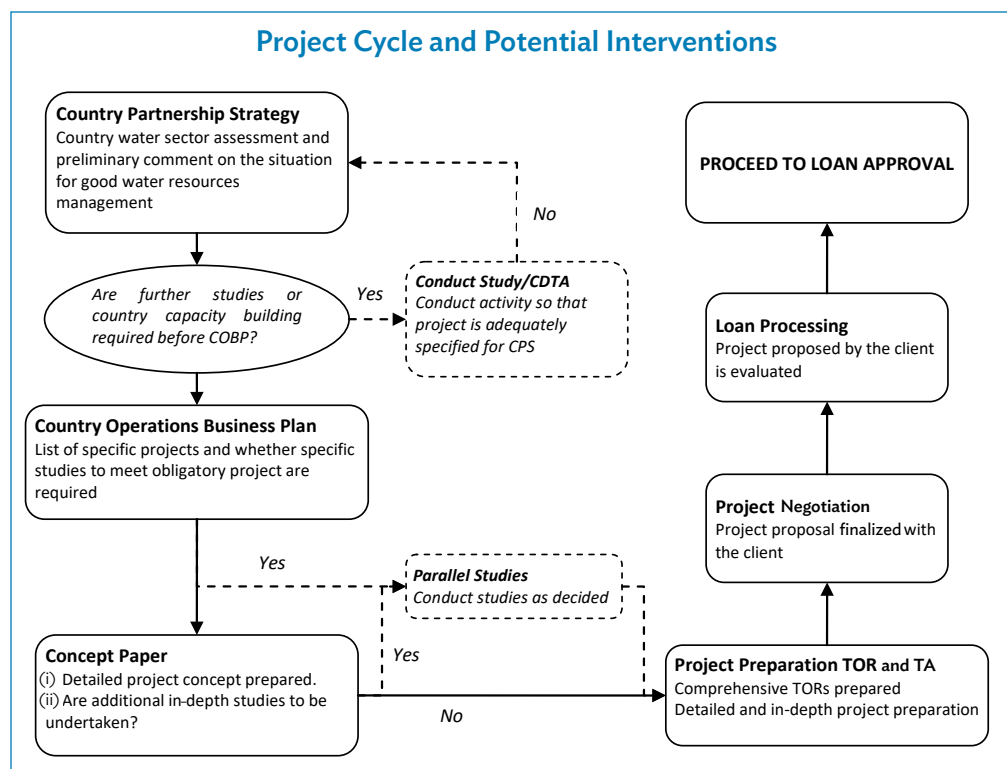
The following priority actions and building blocks have been developed in response to the water policy framework including Water for All policy (2001) and the Water Operational Plan 2011–2020. Recognizing some of the challenges facing the sector, ADB released the Guidance Note: Irrigation Subsector Risk Assessment in February 2015.

To facilitate the implementation of ADB policies for water and irrigation sector projects, it is advisable that

- (i) all project officers equally appreciate the irrigation policies and project expectations;
- (ii) governments are informed of the obligatory requirements for sustainable and loan effective projects at an early stage;
- (iii) there is consistency between ADB projects; and
- (iv) ADB officers reviewing project proposals during the project cycle have a clear list of project requirements so that interventions can be made at an early stage as needed.

The process logic of the ISGN for intervening during the project cycle is shown in the following diagram.

The ADB sector policy could include the obligatory assessments and requirements of ADB water and irrigation projects shown in Table 4.



**Table 4: Recommended Key Elements of ADB Sector Policy for Projects**

Fundamental Project Requirements	Purpose/Comment	Likely Interventions
<b>Programmatic Goal</b>		
Projects to extend from the water source to the farm gate	To encourage projects that are comprehensive and integrated, starting from water resource availability and protection of the water source; the infrastructure to harness and manage the resources; provision of drainage and management of salinity; and the agricultural systems that convert the supply into food and economic value  Such projects should by nature require larger disbursement although to be more complex to prepare	Projects prioritized during concept and later stages so that they are comprehensive and will deliver the purported benefits
<b>Pillar 1: Government Water Policy Institutions</b>		
Assessments of policies and laws	To embed good water and irrigation management in government policies and laws  Only if there is strong government support at the ministerial level, including central ministries, should reforming laws, etc., be undertaken, as otherwise the likelihood of change is remote. It is better to be operationally focused.	An assessment should be made at the country partnership strategy stage, including an assessment of the appetite and support for reform from the most senior levels of government. If reform or strengthening is needed, a supporting policy loan can be provided.

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Table 4: continued

Fundamental Project Requirements	Purpose/Comment	Likely Interventions
Apex government water user institutions	<p>To ensure that all government sectors that use water and have an impact on the water sector are involved in and agree on water-sharing arrangements in the project's river basin(s)</p> <p>As water is used usually independently by different sectors, an apex body, at least at department head level, should be formed to ensure sector agreement and understanding of water-sharing arrangements.</p> <p>The apex body could be at national, state, provincial, or river basin level, depending on the circumstances of the project.</p>	<p>Agreement to create an apex cross-sectoral water institution (unless one already exists) and to strengthen the institution</p> <p>Assistance during implementation to ensure institutional effectiveness</p>
Civil society and water user involvement	<p>To improve water resources planning and management by involving water users, particularly underprivileged farmers, industry and urban water users, and representatives of cultural and environmental water users</p> <p>Projects would include such a consultative group reporting to the apex government water user institution, rather than being formal members, as is the case in some countries.</p> <p>The experience of other developed and developing countries indicates that this group should act as advisers to the apex body rather than be integrated into its membership.</p>	<p>Agreement to create a civil society advisory committee to provide advice to the apex government body on project implementation and water resources management</p> <p>Assistance during implementation to ensure institutional effectiveness</p>
<b>Pillar 2: The Water Resources Manager</b>		
River basin water resources assessments	<p>To ensure that water use and consumption is within the overall availability of water in project river basins and to drive projects to areas and targets where there is scope for raising water use productivity</p>	<p>During project preparation, basin water resources to be assessed, including availability, current and planned uses, provision for the environment, water use productivity, and scope for real water savings</p> <p>Adequacy of hydromet monitoring network, water resources information system, and institutional capacity to be assessed and strengthened during implementation</p>

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Table 4: continued

Fundamental Project Requirements	Purpose/Comment	Likely Interventions
Water sharing and allocation	<p>To ensure that water is shared equitably and transparently and to ensure the sustainable benefits of project financing</p> <p>Water allocations should be made at</p> <ul style="list-style-type: none"> <li>(i) the bulk water supply sector, between water-using sectors (including the environment); and</li> <li>(ii) within irrigation systems, so that scarcity is shared equally by all and total agricultural production is maximized.</li> </ul>	<p>Ideally the assessments should use a combined hydrologic modeling and ET remote sensing approach.</p> <p>Besides undertaking assessments during preparation, projects should include capacity building to embed capacity and systems in water management institutions as a basis for basin planning and water allocation.</p> <p>Current approaches assessed during project preparation</p> <p>Implementation to include the development of a DSS system for this purpose, based on the hydrologic canal discharge model, if such a system does not already exist</p> <p>Capacity building provided to the management agencies</p>
<b>Pillar 3: Irrigation System Management</b>		
Water resource management institutions	<p>To maintain focus on core responsibility and ensure clear financing of projects</p> <p>Water infrastructure planning, management, operation and maintenance will be undertaken by water authorities (state-owned enterprises) that are at arm's length from government water resources departments.</p> <p>These authorities, either singly or in combination, would be explicitly responsible for</p> <ul style="list-style-type: none"> <li>(i) headworks MOM; and</li> <li>(ii) irrigation system MOM.</li> </ul>	<p>Projects to undertake institutional and capacity assessments during preparation</p> <p>Capacity building, and systems and application development, to be provided during implementation</p>
Rightsized and structurally sound infrastructure	<p>To ensure that the infrastructure (reservoirs, river structures, offtakes, canals, etc.) to be modernized is structurally sound and appropriately sized for the available water, considering the possibility of conjunctive use, the LOS required, and flexibility to adapt to changing agriculture patterns during project life</p>	<p>Detailed studies to be undertaken during project preparation</p> <p>MASSCOTE studies to be a requisite part of modernization plan and detailed project reports preparation</p> <p>Rightsizing benchmarks to be applied to ensure that investment is justified</p>

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Table 4: continued

Fundamental Project Requirements	Purpose/Comment	Likely Interventions
Management, operation, and maintenance of bulk water and irrigation network systems	<p>To ensure project life is as designed</p> <p>To maintain agreed LOS to water users to meet agricultural production targets</p> <p>O&amp;M financing, whether from water fees or government financing or a financing arrangement under the loan agreement, to be explicitly required</p>	<p>Capacity and systems for asset management and MOM, to be assessed during preparation and strengthened during implementation including: adequacy of asset management of dam, offtake, and river structures; and measurement and attribution of supply</p> <p>Mechanism for operation and maintenance financing—whether from water fees or government budget or from costs capitalized into the loan—to be agreed on during preparation</p> <p>Impact of less-than-design life on project IRR to be evaluated through sensitivity testing during preparation</p> <p>Provision of O&amp;M to be included in loan covenant</p>
<b>Pillar 4: The Community/Farm Irrigation System Manager (WUA)</b>		
Water user associations	<p>To improve the LOS, and the operation and maintenance of lower levels of the distributary systems</p> <p>Responsibility for these functions to be transferred to water user associations and WUA federations</p>	<p>Status, LOS, systems (including measurement and attribution of supply, and performance of WUA) to be assessed during project preparation and agreement reached with government on its role</p> <p>Support for forming WUA and building systems and capacity for operations during implementation</p>
<b>Pillar 5: The Farm Production Unit</b>		
Increasing agricultural productivity	<p>To ensure that the productivity benefits from the project are actually achieved and not merely assumed and illusory</p> <p>Agricultural and related business skills of farmers to be strengthened</p>	<p>Projects to include building agricultural capacity of farmers</p> <p>Capacity of different options for delivering strengthening to be assessed during project preparation</p> <p>This capacity building could be done through the WUA and involve NGOs rather than government agencies, depending on existing capacity</p>

DSS = decision support system; ET = evapotranspiration; LOS = Levels of service; NGOs = nongovernment organizations; MASSCOTE = Mapping System and Services for Canal Operation Techniques; MOM = management, operation and maintenance; O&M = operation and maintenance; WUA = water users associations.

Source: ADB.

# 6. Recommendations for Implementing the ISGN Approach

This study has presented a framework and a preliminary listing of the building blocks that could form the basis for strengthening ADB irrigation sector projects. It also goes into the scope of indicators in some detail. But for the ISGN approach to be adopted and implemented successfully a number of further steps should be taken. The initially identified steps are discussed below.

## 6.1 Testing the Approach

The recommended “pillars and building blocks” approach is based on the findings of a desktop study, involving discussions with ADB staff and a review of several projects and international experience. It must be tested to ensure that it meets its purpose, and is effective. A concise diagnostic tool for project development (e.g., a checklist) could also be developed and tested in a number of projects before being finalized.

## 6.2 Knowledge and Capacity Building

To achieve the successful implementation of the proposed ISGN approach, the knowledge base must be strengthened and the principal users trained.

### 6.2.1 Project Officers

Project officers will need to fully understand and appreciate the approach:

- (i) The “pillars and building blocks” and what can compromise good and comprehensive water resources and irrigation management.
- (ii) The obligatory elements of the approach including the five institutional levels and the technical requirements. These include river basin and irrigation system water balance, water sharing, and water accounts; MASSCOTE assessments; and MOM, asset management, and the sharing and administration of surface and groundwater use, especially in water-scarce and drought situations. All building blocks should be addressed. Where a building block cannot be addressed fully, an explanation and justification for not addressing the building block should be given to enable reviewers to assess the criticality of the requirement.

- (iii) Appropriate ADB financing options to support reform and better projects (e.g., policy, sector, and MFF loans).

### 6.2.2 Best-Practice Guidance

Practical examples and methodologies for the necessary elements are needed. Currently there is little learning between projects. Often, project preparation involves reinventing, often regressively, rather than building on past successes. Some of the guidance required is in practical and proven models of

- (i) water law and policies (and cross-sectoral links);
- (ii) institutional arrangements and satisfactory institutional and policy assessments;
- (iii) water balance and water sharing in river basins;
- (iv) water resources administration and control;
- (v) levels of service and their implications for infrastructure management in agriculture, on which the success of any irrigation system is founded;
- (vi) asset management, and O&M and its financing; and
- (vii) water user participation.

### 6.2.3 Consultants

International and DMC consultants play an important part in undertaking specific assessments and in preparing and implementing projects. The ISGN and the best-practice guidance notes are prepared to support the approaches taken by consultants. There is a very limited number of qualified MASSCOTE trainers able to undertake assessments. Consideration should be given to training and accrediting midcareer water resources professionals from developed and developing countries and bringing them into the sector.

### 6.2.4 Building the Capacity of DMCs

The involvement and understanding of DMCs during project preparation is essential for effective project implementation. Sometimes DMCs obviously understand and support the infrastructure elements of projects. However, their understanding or support for irrigation MOM can be less clear. As a consequence, the function is sometimes overlooked or not implemented properly. DMCs need to understand these “obligatory” requirements of projects during preparation and before negotiation. The speed of mobilization is also significantly affected by DMCs’ understanding of their roles. Consideration of specific support from ADB to DMCs should be given at the mobilization phase to overcome the initial lack of understanding of ADB requirements and procedures.

## 6.3 Technology and Innovation

Well-established “advanced” technologies used in developed countries, such as laser grading, and drip irrigation for high-value crops, should be readily adopted by DMCs to improve crop water productivity. Additionally, the revolution in information and

communication technology offers paradigm-shifting opportunities, such as advances in irrigation automation, and the operational use of remote sensing in river basin and crop modeling. As various approaches are being pilot-tested and made more suitable to specific circumstances, ADB could position itself in the vanguard of this movement with its DMCs.

## 6.4 Evaluation

There is scant information about the performance of past projects over a longer term period of 10-15 years following completion. Diagnostic evaluation would demonstrate which approaches succeeded, and deepen understanding of long term project sustainability and the key elements that require special attention. Invaluable lessons would be gained for future project design, implementation and capacity building.

## 6.5 Media and Communications

Irrigation is an important sector that is critical to food production and food security, and a source of water for the cities of the future. The sector has relatively low visibility. DMCs, with their large rural populations and the stark reality of food insecurity, are highly aware of the significance of irrigation. Pushing the sector to increase food production while reducing its water use will help these countries find the water they need, particularly as they urbanize. A targeted communications strategy is needed to showcase the relevance of irrigation, and to increase awareness. Its successes, and not just its disappointments, must be demonstrated.

## APPENDIX 1

## Sustainable Development Goals

No.	Goal
1	End poverty in all its forms everywhere
2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Ensure healthy lives and promote well-being for all at all ages
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Achieve gender equality and empower all women and girls
6	Ensure availability and sustainable management of water and sanitation for all
6.1	By 2030, achieve universal and equitable access to safe and affordable drinking water for all
6.2	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.7	By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
6.8	Support and strengthen the participation of local communities in improving water and sanitation management
7	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10	Reduce inequality within and among countries
11	Make cities and human settlements inclusive, safe, resilient and sustainable

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No.	Goal
12	Ensure sustainable consumption and production patterns
13	Take urgent action to combat climate change and its impacts*
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development

\* Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

Source: United Nations. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>



## APPENDIX 2

# Factors Contributing to the Additional Complexity of Irrigation Projects

The complexity of irrigation projects and their management derives from various factors, including the following:

- (i) The outcomes of projects have mostly not had transformative impact but instead amount to (a) reclaiming benefits forgone as infrastructure has degraded, and (b) providing an opportunity for enhanced level of service.
- (ii) Although still sizable, loans are significantly smaller than those for other sectors that are more infrastructure dependent and concentrated, such as transport and wastewater treatment. Irrigation projects by contrast mostly involves individually small-scale capital works spread over large geographic areas involving diverse groups' understanding and commitments.
- (iii) Projects must consider and involve many stakeholders including governments at multiple levels, river basin agencies, discrete irrigation system operators and achieving project economic benefits substantially rests with many individual water users.
- (iv) Effective management of the overall water resource underlies success however there are conflicting water users including the environment, provision of basic human needs, fishing, agriculture, industry and energy.
- (v) Control and conservation of water is challenging without an effective measurement, control and enforcement approach. As a result, upstream water users have beneficial supply arrangements and water losses are difficult to control.
- (vi) Noninvestment in maintenance is an easy option for governments as degrading or poorly managed infrastructure is not noticeable for some time as systems slowly slip into disrepair and operations worsen.
- (vii) The performance of the farm level is constrained by other factors such as the small size of landholdings, capital and technological access and capacity.
- (viii) Many social and cultural issues can interfere with project implementation including the potentially large number of affected peoples as a result of the large area affected by projects as well as differences in social power and status.
- (ix) Communication and consultation with water users, particularly farmers, are limited in most DMCs and in many cases with limited appreciation from agencies. As a result, consultation during project design and operation is difficult and affects results.

- (x) Water theft, infrastructure vandalism, avoidance of water charges and corruption are not uncommon features of irrigation sector projects.
- (xi) The number of experienced consultants is diminishing as they retire and are not replaced by the next generations who seek training and employment in other sectors that are seen to be higher paying, with more employment opportunities and enable living in centres with more facilities and opportunities generally.

## APPENDIX 3

# ADB Definition of Irrigation Modernization

**Modernization is**

*the process of upgrading infrastructure, operations and management of irrigation systems to sustain the water delivery service requirements of farmers and optimize production and water productivity.*

“Process” implies that systems modernization is a continuous exercise. It must account for future changes in the irrigation system and service requirements of the farmers. Ideally the process will align with existing government development and budgetary time frames and systems.

“Upgrading” means improving beyond what already exists, not replacing or rehabilitating. It means applying design best practices to infrastructure to optimize operation requirements and maximize system performance and efficiencies.

“Infrastructure” refers to all physical assets related to the irrigation system, including headworks, conveyance systems, drainage systems, monitoring systems, communication systems, farm and access road networks, operation buildings, etc.

“Operations and management” refers to all human resources and management processes responsible for managing, operating, and maintaining the irrigation system including groundwater and surface water management, and the associated physical infrastructure.

The “irrigation system” brings together all physical and nonphysical components that contribute to converting water and nutrients into food and fiber. These include the infrastructure, water resources, agency staff, farmers, service providers, supply and market chains, etc.

“Sustain” means that the irrigation system will continue to operate at its optimal performance. This includes managing the water resources to account for reallocations to other users, prevent adverse depletion, and enhance resilience to climate variability and the anticipated impact of climate change. It also means ensuring that all costs relating to the management, operation, maintenance, and asset depreciation of the system are affordable and are fully covered by government, user (farmer), or private sector financing.

“Water delivery service requirements of the farmers” means ensuring reliable, adequate, and flexible supply of water, as agreed on with farmers, allowing them to maximize water and agricultural productivity. Farmers are required to be involved in the planning, design, and operation of the irrigation system, and in routine water management decisions.

“Optimize production and water productivity” means farmers must endeavor, with technology and extension service support, to optimize the productivity of their land with the available water.

## **Irrigation Subsector Guidance Note**

*Building Blocks for Sustainable Investment*

One irrigation subsector goal of the Asian Development Bank is to produce more food with less water. Estimates suggest that food production in the developing world must double by 2050. By that year, urban and industrial water demand will have increased from 20% of total regional demand to 40% (about 80% of that water demand is for irrigation). This publication helps define core support areas in the irrigation subsector and set the course for country partnership strategy investments in irrigation for lending and nonlending assistance. See how this guidance note can assist and strengthen the preparation of projects that increase food productivity and security, use water within the resource availability limits, and produce long-term benefits.

### **About the Asian Development Bank**

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to a large share of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

*Securing Water, Sustaining Futures*



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