Chapter 18: Irrigation Systems

MCC will use the feasibility study as the basis to examine the following and to make a determination on what supplemental studies, if any, are required to develop the project sufficiently so that appraisal could commence:
Preliminary description of rationale, including nature and measure of benefits, and beneficiaries.
Technical viability and proposed technical solutions.
Demonstration, supported by appropriate data, that the proposed project is likely to deliver the stated agricultural benefits to various beneficiary groups.
Definition, assessment, and evaluation of current and projected land and water uses in the proposed irrigated and/or flood areas. Identification of options for changing land and water uses to maximize operating efficiencies for existing and future systems, and identification of land resources for long term development, including an analysis of impacts based on access to land resources and land ownership by gender, age, income, and ethnicity.
Assessment of market demand for increased agricultural production and water use to financially, economically and operationally justify the project. The assessment should take into account total costs of operations, and forecast the future growth of demand for water use, including a gender-competent value chain analysis.
Demonstration that sufficient reliable hydrology information has been provided in feasibility reports on issues such as river stage and discharge or borehole yield and drawdown, total solids in suspension, total dissolved solids, and specific substances in suspension and solution.
Demonstration that satisfactory land classification and soil suitability surveys (i.e., auger holes, trial pits) have been used or survey results have been tested for validity.
Demonstration that realistic crop water requirements (including studies of evaporation ratios of open water surfaces) have been estimated sufficiently using climatologic data from adequate and reliable records and that factors such as field level water control technology are taken into account (an error of 20% in crop water use estimates can make a considerable difference to the economic analysis, especially if water cost is a major constraint).
Demonstration that there are no constraining hydrological issues related to capacity of water sources and conveyance structures by examining actual data (preferably climatologic data over 25 years), identification of competing water uses (between households and industry and within households for different water uses), and confirmation that there are no constraining contamination impacts on water availability.
Identification of related policy, legal, regulatory, and institutional frameworks, including land ownership and use rights by gender, and any existing water rights or water user association laws. Evaluation of their potential impacts and implications on project implementation and implications for control or management of resources by gender, age, income, or ethnicity.
Identification of existing or proposed irrigation system management arrangements.
Identification of data gaps and areas that require more detailed, current or confident information.
Identification of key elements of existing and proposed infrastructure, rights-of-way, and service areas using satellite imagery and topographical maps at the appropriate scale (typically at 1:10,000 or 1:20,000 for feasibility level; 1:5,000 for detailed design). In addition, it may be appropriate to identify other geo-spatial data – including, but not limited to, census data, water resources, and geological data – and combine them into a single GIS database.
Meaningful public consultations (including gender, age, and income-based focus groups in rural and/or urban areas where relevant) among project affected persons and key stakeholders including women's civil society organizations.
Description of the local process by which the project will receive the necessary permits and approvals of design documents and construction work.
A preliminary description of the applicable local and regional laws, regulations and codes, as well as international agreements/treaties, related to the project.

Once MCC has made the determination to commence appraisal, the infrastructure group will conduct the following assessments and identify any key constraints:

Technical Assessment: Engineering

- ★ Review all aspects of preliminary and detailed technical designs and proposed standards and confirm appropriateness for design criteria, demand requirements and environmental and social factors including design appropriateness for use by various beneficiaries (taking into consideration use and cultural appropriateness by gender, age, etc.).
- ★ Assess the adequacy of soil surveys (soil structure, vertical and horizontal disposition, permeability, pH value, salinity, soil depth and topography) to define soil types, drainage characteristics, and agricultural potential.
- ★ Review and confirm the hydrological surveys and water resource availability assessments using long-term records of river flows and water quality. In the absence of historical data, such analyses may include estimates based on simulation models using rainfall records for the catchment or stream flow of neighboring rivers. Validate the yield studies (including instream flow requirements and considering catchment erosion and sedimentation).
- ★ Review and confirm any hydrological evaluation for assessing proposed project's impact on the appropriate watershed.
- ★ Review and confirm topographical surveys of irrigable areas and locations of canals, buildings, roads and hydraulic structures.
- ★ Review and confirm site exploration, including exploration of such sub-surface conditions that may affect the design and construction of a proposed substructure such as the mechanical properties of the subsoil at foundation levels and the corrosiveness of the groundwater. Confirm the strength of underlying soils.
- ★ Assess structural engineering aspects of any proposed dam structures (including mapping of the bedding planes to confirm shear strength parameters) and propose appropriate detailed modifications.
- ★ Review the proposed water control concepts and the associated technology, with a view toward efficiencies (manually operated gated systems have very low efficiencies and provide poor service to the users).
- ★ Review and assess specifications for any pumping plants/stations (including any power extensions) and assess maintenance capacity, including power supply.
- ★ Review preliminary and/or detailed engineering designs and confirm that these designs provide sufficient prebid cost estimation.
- ★ Evaluate design standards and propose alternatives when existing standards are not acceptable to MCC.
- ★ Review and confirm assessment of availability of local materials and required plant and machinery.
- ★ Confirm that proposed storage facilities take into account crop water use, domestic and livestock requirements, conveyance losses, and corresponding flow rates.
- ★ Confirm preliminary estimates of on-farm works as the basis for estimating total costs for economic analysis.
- ★ Confirm assessments of drainage requirements for different categories of land use applied to typical soil profiles and verify that that the drainage system (from field drain to outfall) is adequately coordinated with the canal system.
- ★ Identify other factors that can affect cost or scheduling, including site preparation, access roads for construction, utility provision (including possible encroachment and relocation), construction camps and potential health and safety safeguards including HIV/AIDS risk management, potential resettlement, environmental clean-up, and equipment mobilization and de-mobilization.
- ★ If any dams are classified as "large" by the International Commission of Large Dams (ICOLD), ensure that all appropriate environmental and social evaluations and engineering design and safety criteria are met, as well as the appointment of a dam safety panel.
- ★ Confirm that meaningful public consultations (including gender, age, and income-based focus groups where relevant) among project affected persons and key stakeholders, including women's civil society organizations, have been undertaken.
- ★ Identify major project risks and quantify, as much as possible, the impact of these risks on project cost, timeline and quality. Develop mitigation measures and estimate the cost of mitigation.
- ★ Develop project cost estimates for the purposes of investment decision, including all associated costs, such as costs relating to environmental mitigation, resettlement compensation, social safeguard measures, construction supervision, project management and technical audits.
- ★ Develop provisions to be included in project cost estimate, such as physical contingency, allowances for specific risks that were identified in appraisal, price contingencies, and allowance for the effects of foreign exchange rate fluctuations, and determine meaningful rates of inflation – local and foreign – to apply to base costs.

Technical Assessment: Economic and Financial

The MCC economist responsible for the assessment of the project will work to ensure that proposed irrigation project complies with *MCC Guidelines for Economic and Beneficiary Analysis*. The economic rate of return for each project should be sufficiently high to warrant investment and eligible countries should have reviewed relevant governance practices, including laws and regulations, and undertaken reforms, as possible, to enhance the anticipated economic benefits generated by the irrigation project. Infrastructure input to this analysis may include the following:

- ★ Identify benefits expected to flow from the project, focusing on increases in incomes for workers, firms, households, and beneficiaries within households. Identify the beneficiaries, to the extent possible, disaggregated by gender, age, income, and ethnicity. Compare projected incomes of disaggregated homogeneous beneficiary groups and other benefits with and without the proposed project.
- ★ Summarize the design standards, design life and cost estimates (capital and maintenance) and confirm these are consistent with the assumed benefits and duration of the benefit stream. Note that the duration of the benefit stream is typically assumed to be twenty years. Assumptions that the duration is longer or shorter than this should be clearly justified.
- ★ Confirm that the costs and project life are consistent with the engineering design.
- ★ Complete a financial analysis and FIRR for income generating subprojects.
- ★ Confirm that the technologies that are proposed in the project and the engineering design will allow fulfillment of operational performance, as well as financial and economic objectives based on analysis of use by disaggregated homogenous demographic groups.

Technical Assessment: Environment, Social and Gender

MCC environment and social assessment and gender experts will review the proposed project for compliance with MCC Environmental Guidelines, Gender Policy, and resettlement guidance (www.mcc.gov), which include an expectation of compliance with host-country laws, regulations and standards, as well as requirements by which the host country is bound under international agreements. Particular attention must be paid to issues which generally arise including, but not limited to, land ownership and right of way, incursion into sensitive areas (reserves, parks, wetlands, etc.), drainage and erosion control (especially in hilly or mountainous situations). Assessment will also inform design by including gender analysis of use, control of resources, design appropriateness, and how well gender is integrated into project design, participatory planning processes, and implementation.

- ★ Identify country-, region- or sector-level assessments, strategies and commitments with respect to climate change and their relevance to compact activities.
- ★ Identify climate change impacts (from the project) and risks (to the project) and corresponding mitigation and/or adaptation opportunities, as relevant.

Technical Assessment: Legal

The MCC legal staff will work to ensure that proposed irrigation project neither encounters any legal obstacles nor violates any existing laws. The MCC legal staff will also assist in reviewing relevant governance practices, including laws and regulations, and any reforms the country has or proposes to undertake. Finally, MCC legal staff will, if necessary, review and comment on any contracts related to the proposed infrastructure project. Infrastructure input to this analysis may include the following:

- ★ Identify government policies and regulations specifically related to the project's construction, operation and maintenance. Identify any international agreements specifically related to such construction, operation and maintenance. Identify any issues arising from such agreements, policies and regulations.
- ★ Identify any governmental agencies or other entities whose cooperation and assistance are necessary to the success of the project.
- ★ Identify the proposed chain of ownership of the project, and whether any changes in ownership will be needed upon the end of the proposed compact.
- ★ Identify any unusual arrangements that need to be made with any contractors performing work on the project.
- ★ Confirm that the technologies that are proposed in the project do not require any exemptions from local import regulations.

Sustainability Assessment

- ★ Review detailed description of current arrangements for ownership, management and maintenance of irrigation systems, including details of the legislative framework, administrative framework, funding arrangements and maintenance responsibilities.
- ★ Review existing performance with respect to clarity and acceptance of management arrangements and responsibilities, acceptance of irrigation funding reserves for maintenance. Identify causes of inadequate performance including legislative or administrative arrangements, resources, technical capability and capacity, and funding.
- ★ Review maintenance programs to ensure that such plans are suitable for the new irrigation systems including responsibilities, resources, funding. Identify shortfalls with current arrangements and provide details of a program to strengthen irrigation system management and maintenance arrangements.
- ★ Review details of alternative maintenance funding options, including details of income derived from water users and potential for increased cost recovery.
- ★ Prepare a summary of actions needed to maintain any dams and water management to acceptable level, including institutional strengthening, funding (responsibility and funding levels), a social and gender integration plan, and additional resources needed.

Risk Management Assessment

- ★ Identify significant risks to the project, with particular respect to construction cost increases, adequate scheduling and delays, management and sustainability of the scheme, local acceptance and take-up of benefits, and other factors affecting economic performance and distribution of benefits including social and health factors such as impacts of potential resettlement, HIV/AIDS, human trafficking, child or forced labor, and existing gender inequalities in water resource management, agricultural production ownership and management, land ownership and management, participation, or labor wages and benefits.
- ★ Identify and assess significant risks relating to durability, and confirm that design criteria adopted shall mitigate these risks within acceptable tolerance levels.
- ★ Prepare a risk management plan to minimize the negative impact of the risks.

Implementation Assessment

- ★ Review and confirm availability of local construction capacity in view of other competing projects in the same time period.
- ★ Define all activities that are required to be completed prior to the commencement of the construction related activity, such as detailed engineering design and RAP, and develop Terms of Reference for these studies in association with the country counterparts or the implementing entities (cost of completing these studies should be included in the project budget).
- ★ Identify and critically assess implementation and contract management options.
- ★ Identify local factors that may affect the timely completion of the works, including transport to/from the location for the contractor's equipment, fuel and other materials, seasonal weather patterns such as avoiding the wet season, and health and safety factors including HIV/AIDS impacts on the labor force and migratory trends.
- ★ Prepare an implementation program (work plan) including contract awards, any approvals and permits needed, construction times and floats, cash flow, contingencies and management reserves, government commitments and other hold points as appropriate.
- ★ Recommend an appropriate procurement procedure, sequencing, packaging and time frames.
- ★ Recommend suitable supervision and management arrangements during construction and management arrangements during operations.