Evaluating Economic Benefits
The Conceptual Framework

Project Approach and Methodology

The irrigation benefits and impact evaluation has been based on the methodological framework shown in Figure 19 that combines information, evaluation and analysis. This approach has used the latest information available from international, national and western provincial sources, developed a series of irrigation outlook scenarios based upon reasonable expectations of future prospects, introduced sensitivity analyses to assess the risk of change and alternative approaches to project development and identified the major barriers and constraints to the developments. Illustrative case studies and examples of critical impact or benefit areas have been highlighted throughout the analysis.

Figure 18
Methodological Framework for the Saskatchewan Irrigation Social, Economic and Environmental Benefits and Evaluation Project
Economic Impact Evaluation Framework

Irrigation investments commonly have effects that extend well beyond the impact on the farm. Water distribution systems often service many farms and the existence of secure supplies of irrigated agricultural products can lead to the development of many further economic expenditures and benefits throughout the agricultural and rural value chain. Not all of these effects are to be found in the irrigation districts and many extend to the larger cities and the rest of Canada. Public expenditures are often used to finance investments in regional irrigation distribution works and at times as contributions to on-farm investments in irrigation equipment and private investments in value added activities.

The evaluation of direct, indirect and induced effects of the irrigation investments are analysed in the context of a regional economy. This is shown schematically below and systematically defines the forward, backward, direct, indirect and induced effects of the irrigation investments. These arise from both the agricultural economy, new building blocks in the regional economy and the macro economic effects of the investments and related operations on the labour force and through the wider economy. Input Output Analysis and Cost Benefit provide analytical frameworks that can be used to evaluate the effects of both public and private investments on the wider society at large.

Figure 19

Methodological Framework for Forward and Backward Linkages in the Irrigation Economy

Source: Kulshreshtha and Grant 2002.
Concept of Economic Impacts

Economic impacts are created through re-circulation of money in a given economic system. For example, in order to add more area under irrigation, agricultural producers must spend money for purchasing machinery and equipment, on building infrastructure for bringing the needed water from the source to the fields, and for other related activities. These expenditures send a signal to those firms that produce these goods to expand their output in order to meet this new demand. Increased demand for these goods triggers an increase in their respective production, which on one side creates demand for inputs (thereby generating the same type of chain reaction as above), and on the other side, generates more income in the hands of workers employed in these industries. The latter becomes another avenue for more economic changes in the economy. Workers must spend the newly earned income on goods and products of their own necessity and create more demand for goods in the economy. Estimation of all of these types of changes are targeted in an economic impact assessment of irrigation in the Lake Diefenbaker Development Area (LDDA).

Economic impacts from irrigation development activities can be classified under various categories. Three most common categories of economic impacts are Direct Impacts; Indirect Impacts and Induced Impacts

The most obvious impacts of an irrigation development are the direct impacts. These are the economic activities that are undertaken by those who are directly related to the project itself. In the context of irrigation, these would include various types of expenditures incurred for off-farm works, on-farm investment in machinery and equipment to use water for various crops, and purchase of inputs for production of various crops.

Indirect impacts result from the actions that are undertaken by those economic agents in the direct impact generation. Since applying water to crops on farms requires some investment in machinery and equipment, and production of crops under irrigated conditions require certain inputs, these decisions lead to higher demand for these products. Newly created demand level triggers production of these goods by other industries in the region or elsewhere, which in turn, creates demand for their own inputs to be produced by other industries. This process continues until all the goods needed for this expansion are produced and delivered to the project. A sum of all these economic changes is called indirect impacts.

The third type of economic impacts is realized through actions of the people who receive compensation for their contribution to either at the direct impact level or indirect level. Consumers are owners of labor resources that are employed through various activities related to the irrigation projects. Thus, as an economic activity takes place, a portion of the gross sales is received by workers and management as wages or profits. This newly earned income fuels demand for consumer goods and services. Except for savings and direct taxes, all this income thus earned is spent. These expenditures create new demand for products, which are now produced by various sectors in the economic system, thereby, creating another round of economic impacts. These impacts are called ‘consumer-induced’ or just induced economic impacts.

Although direct impacts are specific to the project, indirect and induced effects can be identified through various linkages that develop over time with the irrigation development project. Three types of linkages that can be identified include: Backward Linkages; Forward Linkages and Agglomeration Economies Linkages.
Backward linkages are formed through purchase of inputs needed for the production process of the project. These linkages create both indirect and induced economic impacts, as described above. Forward linkages are formed as the project produces goods that are used as inputs by some other industries for further processing or value-added. Again, these linkages also generate the above two types of economic impacts – indirect and induced. The third type of change – agglomeration economies related linkages, are experienced in the long run. On account of changing economic environment, other industries may find the project region attractive for conducting their own business. Some of these may be partially related to irrigation development, while others may be related to consumer goods and services. These new industries either sell goods to the irrigation project or to the industries that have backward and forward linkages with the irrigation project. These changes also generate both indirect and induced economic impacts.

An overview of these economic impacts is shown in Figure 20. Total economic impacts of a project are a result of all direct, indirect and induced changes described above. All changes are additive in nature.
Scoping of Economic Impacts of Irrigation in the LDDA

Since indirect and induced impacts are triggered by direct impacts, estimation of economic impacts of irrigation development in the LDDA requires identification of various economic activities that may lead to total economic impacts. This requires identification of various direct activities associated with irrigation development in the region. For the sake of clarity, total economic impact of irrigation development in the LDDA is categorized under nine separate types of development activities.

Direct Impacts of Irrigation Activities
Investment Phase:
- Development of needed water delivery infrastructure from source of water to the fields.
- Development of on-farm water delivery equipment.
- Purchases of farm machinery and equipment.
- Construction of farm level storage for products of irrigation origin, particularly cold storage shed for perishable vegetables and potatoes.

Operations Phase:
- Agricultural production activities with irrigation.
- Purchase of farm inputs needed for irrigated production.
- Higher net farm income in the hands of landowners and hired workers.

Indirect Impacts through Backward Linkages of Irrigation Activities
- Purchase of raw materials and other farm inputs from various suppliers.
  - Increased production of directly impacts backward linked industries.
  - Increased sales of other industries in the region triggered by irrigation development more indirectly.
  - Increase in the local employment.
  - Support of the local communities.

Induced Impacts of Income Received by Producers from Direct Project Activities
- Re-spending of the income and resulting increased economic activities.
- Support the local communities.

Induced Impacts of Backward Linkages of Irrigation Activities
- Re-spending of earned income from irrigation development, by those engaged in the provision of farm inputs.
- Increase in local employment.
- Support of local community.

Forward Linkages of Irrigated Production (Direct Impacts)
- Investment Phase
  - Development of new processing infrastructure for products produced under irrigation.
  - Development of new wholesaling and distribution establishments for such products.
- Operations Phase
  - Production activities and purchase of inputs for production.
  - Employment of workers for such facilities.
Indirect Impacts of Forward Linkages of Irrigated Production

- Purchases of raw materials (except from farm level activities) for such activities.
- Vertical integration of some aspects of marketing chains in selected products.
- Employment of workers for such activities.

Induced Impacts of Forward Linkages of Irrigated Production

- Re-spending of income earned by workers in the processing industries.
- Re-spending of income in the warehousing and distribution establishments.

Associated Development Impacts

- Capital expenditures on related infrastructure, such as roads, water treatment and sewage facilities.
- Indirect and induced impacts of these developments.

Agglomeration (Future Spin-Offs) Impacts of Irrigation

- Attracting new industries in the region for secondary processing.
- Attracting new input supplying industries for irrigation, processing and other economic activities.
- Indirect and induced impacts of the developments.

Many of these impacts are interrelated and occur at different intervals over time. Economic activities related to irrigation development typically contain two major phases: One, a short-lived construction or capital works program phase, and two, a more sustained and long-run operations phase, including various economic activities related to maintenance and farm level operations. A distinction between the one-time effects from investment phase vs. recurring effects during the operations phase needs to be taken into account in the estimation of total economic impacts of irrigation development in the LDDA.

Estimated Economic Impacts of Irrigation

Many of the above-listed economic impacts are not easy to conceptualize and even more difficult to measure empirically. These were therefore, not included in this study. A list of excluded economic impacts included the following:

Community Level Impacts

Community level economic impacts require analysis of changes at individual community level. In order to undertake this type of impact assessment, various communities need to be looked at in details. This was considered not feasible; thus, study impacts are limited to sub-regional level.

Agglomeration Effects of Irrigation Development

Agglomeration effects of irrigation development, although real, are more dynamic in nature. In addition, these changes are felt in a more distant future. Furthermore, factors such as changes in public policies, changing rates for utility services, and a changing attitude by the populace for different lifestyles may affect the nature and extent of these future developments typically included under this category. Even their estimation based on existing changes requires primary data collection, which was not considered feasible for this project. For these reasons, these economic impacts are not included in the study.
Associated Infrastructure Related Impacts

In many smaller communities and rural areas, infrastructure may not be adequate for supporting irrigation development and/or forward linkages. Changes in power distribution system, road networks, rail transportation links, or waste assimilation facility may be required for attracting some of these industries. This requires examination of site-specific situation. In the context of this project, it ran into two problems: One, sites for various building blocks is not clearly identified; two, examination of adequacy of supporting infrastructure was considered to be beyond the scope of this project.

Other Environmental and Socio Economic Consequences of Irrigation Developments.

In addition to the statistical analysis of economic impacts, there remain areas of significance for the evaluation of irrigation benefits. Many of the water systems developed initially for irrigation and financed by irrigation districts benefits groups outside of the farm. They include for example, the wetlands that are created along the regional water distribution systems, the municipal water supply networks, potash mines with access to previously unavailable water resources and golf courses kept green by the irrigation waters.

However, perhaps one of the largest groups of non-irrigator users of agricultural waters are the tourists who flock from the cities into Lake Diefenbaker to play and fish in the waters and to hunt waterfowl around the lake. Large numbers of urban residents return to the country each summer to stay in one of the many campgrounds on the shores of Lake Diefenbaker and along the Qu’Appelle Valley. Cottages line the shores of most of the major water storage reservoirs and related waterways and pay large premiums for waterfront property.

Together, all of these uses provide important additional benefits that are derived directly from the irrigation economy.