

# THE ECONOMIC EVALUATION OF LAND DEVELOPMENT PROJECTS<sup>1)</sup>

D. GROENVELD

International Bank, Washington, U.S.A.

## SUMMARY

1 Most methods recommended for the economic evaluation of land development projects are too refined for application to projects in underdeveloped areas. The author suggests, therefore, the use of a simple method in these areas.

2 The economic effect of a project should be estimated with respect to the national economy, to the entrepreneurs (farmers) in the project region, and to the government.

3 Most evaluating methods ask for an estimate of net benefits. There is however doubt whether this is necessary and feasible. An estimate of gross benefits seems all that is really required.

4 The traditional cost/benefit ratio calls for a conversion of investments into an annual figure. This conversion has to be done in an arbitrary way and is undesirable.

5 It is therefore proposed to compare project costs (investments) with the increase in gross value of agricultural production, in other words: to use a capital/output ratio.

6 The article discussed briefly how to find the maximum acceptable capital/output ratio.

7 However, one has to estimate the increase in costs (in terms of current expenses) for the private interest test. In many cases this increase in costs will be small if compared with the increase in output, in view of the importance of non-monetised costs and of fixed costs.

8 The repayment capacity of the farmers will usually increase adequately if a project has a favorable capital/output ratio, and if it passes the private interest test. However it is also important that the investor (usually the government) earns a reasonable return on his investment.

## INTRODUCTION

In the minds of the present generation the need for a justification of investments in large projects arose during the depression of the thirties. This need became even stronger in the postwar period, first for reconstruction works and later for development works. The need originates from a situation in which there are a great number of claims for a limited quantity of means to satisfy them. Investment capital is the most general means "in short supply".

During the last three decades a great number of studies have been made seeking a satisfactory way to measure the economic feasibility of major projects, so that a priority rating could be established. Several more or less refined methods have been developed, and several ways to test the economic feasibility of a project have been formulated. Most of the methods require more data than can reasonably be made available, as we will discuss later.

The list of publications, appended to this article, includes only a small selection out of the sea of literature on this subject. Most of the original thinking has been in the advanced countries (see however 1) and some of the methods developed for use in these countries have been transplanted without critical scrutiny to underdeveloped areas (see 2 and 5).

This practice may lead to wrong conclusions since the evaluators who use a refined method on a project in an underdeveloped area may feel obliged

---

<sup>1)</sup> Received for publication January 30, 1959.

to quantify categories of costs which cannot under those conditions be expressed in sums of money.

For instance there is usually a great deal of disguised unemployment and underemployment in those regions, which means that the "real" value of labor is less than the wages paid for construction work. On the other hand capital is often in short supply and the "real" rate of interest may be higher than the rate charged to construction firms and farmers. Prices of construction equipment and materials also do not always reflect their real economic value; they are often manipulated prices.

With respect to farming: most of the work on the farm is usually done by members of the farm family, without money transaction. Often the labor supply is such that labor hardly has an economic value. It is also true in many cases, especially under pre-project conditions, that the farm is primarily run to supply the needs of the farm family and that only a limited amount of the production is sold for money. In the case of mixed farms there is the problem of intra-farm deliveries (feed crops to cattle, manure to croplands, etc.), which can only be disentangled by painstaking and time-consuming research work. It is for these reasons, combined with a shortage of competent research workers in underdeveloped areas, not surprising that reliable data about expenses of farmers in such areas are very rare.

With respect to benefits: these are in many cases very large, in the sense that increases in gross production of 100%—400% are sometimes foreseen in areas where a primitive form of dry-farming is practised before the project begins to operate. In many cases irrigation means the difference between no crop at all and a rich crop.

To sum up: the special conditions under which cost/benefit analysis has to be applied in underdeveloped areas are: underemployment of labor, scarcity of capital, manipulated prices of materials, lack of cost data on farm operations and possibility of large increases in gross production.

It is in most cases advisable to investigate the economic feasibility of a project with respect to:

- a the national economy (influence on national income, balance of payments);
- b private enterprise (farmers);
- c the government (or the project agency).

The benefit/cost ratio is usually recommended to assess the economic merits of a project with respect to the national economy. This ratio will be discussed first and it will be shown that the benefit/cost ratio is not a good instrument for this purpose, at least not for projects in underdeveloped areas. The capital/output ratio, which will be discussed later, seems a more suitable determinant.

#### THE BENEFIT/COST RATIO

This ratio is established by estimating the annual benefits produced by the project and by dividing them by an estimate of the annual costs.

Great care should be taken to include in both categories only those elements that really should be included. If one calculates the benefits on the basis of ex-farm prices (direct benefits) one should include only costs required to produce the crop on the farm (project costs and associated costs). However, if one includes indirect benefits one should also include the indirect costs.

Although the difficulties of estimating the direct benefits should not be belittled, they are certainly less in number than the problems connected with an estimate of annual costs. The total annual costs of the project are in a simplified example (page 41 of the U.N.-Ecafe report 2) shown as the sum of the annual equivalent of capital costs and the annual costs of operation, maintenance and replacements. This report recommends (page 38) for translating the capital costs into an annual figure, taking the average long-term borrowing rate of government offerings. Such rates are however not available in many underdeveloped countries, since their governments are often not in a position to borrow in a free market. Also a rate of depreciation has to be established. The report includes a table which gives in great detail the conventional "estimated lives" of many construction features. The estimated life of dams is put at 100 years, of canal linings at 50 years, etc. These are all very rough rules of thumb. The useful life of a dam depends very much on special conditions, such as the type of construction, the rate of silting of the reservoir, maintenance, etc. Moreover the rate of interest and the rate of depreciation are very arbitrary figures, and the question arises whether they can be used for refined calculations.

Many publications conceive of benefits as the increase in net annual farm income, which means that one has to deduct farm costs from the estimate of the increase in gross farm income. Some reasons why it is difficult to collect reliable and meaningful cost data about existing farm operations have already been mentioned; however attention should be drawn to a difficulty that arises when one has to estimate costs of future operations, if the character of the farm business changes completely. The effect of an irrigation project is often the transformation of a simple nearly mono-crop farm into a much more complicated diversified farm. This raises such questions as: what will be the effect of more manure on crop yields; what is the food or fodder value of unsaleable portions of crops; what is the fertilizing value of a legume crop; what are the costs of using a multi-purpose animal for farmwork, etc.? The whole problem of the effect on costs of transforming a simple farm into a complicated one with supplementary and complementary "divisions" makes it rather unrealistic to try to estimate future costs of production. This holds with even more force if the project involves development of an entirely new type of enterprise in the region since there is no source of comparative cost data.

The combination of these difficulties and the inaccurate character of many of the data, make the benefit/cost ratio a rather unsuitable concept for the measurement of the economic merits of a project. The ratio, often given in two digits behind the decimal point, suggests a measure of accuracy which it really does not have.

#### THE CAPITAL/OUTPUT RATIO

The capital/output ratio is established by dividing the sum total of the investments in the project (public and private investments) by the estimate of the increase in gross farm production.

In "capital" should be included the investments in all the public works that serve directly or mainly the purpose of increasing farm production (the costs of irrigation works, drainage facilities, farm to market roads, power lines to farms or pumping stations, but not buildings for general governmental pur-

poses, or general schools). Investments in the farms necessary for using the irrigation facilities should be included (farm ditches, levelling and terracing, farm buildings, equipment, working capital).

The Italian concept of "gross saleable production" is probably the best way to measure "output". This concept includes the goods actually sold, plus imputed sales to farm households. However, "sales" of feeds to the livestock department of the farm are excluded (see 4 and 6).

By using this ratio one eliminates all the problems of reducing capital costs to an annual figure and of deducting farm costs from gross benefits. However is it right to disregard costs of operating and maintaining the project works, and the costs of farming? In the opinion of this writer one is justified in doing this at this stage of the research work, that is, while ascertaining the effect of the project on the national economy.

The costs of operating and maintaining the project works are only partly "costs" to the nation and they are as a rule insignificant if compared with national income or government budget, so that hardly anything is lost in eliminating them at this stage.

More consideration ought to be given to disregarding farm costs. They consist broadly of the following elements: purchases of farm requisites, payments for services (transport, veterinarian, etc.), rental payments, interests on loans, wages for outside labor, taxes. All these elements are costs to the farmer, however several of them are not costs to the national economy, especially not in the conditions prevailing in underdeveloped areas. The use of farm requisites has to be considered as a cost because they, or at least the raw materials used in manufacturing them could have been used in a different way, if there were no project. Part of the payments for services are no social costs, because several of these services would be used by the farmers also without the project. Payments for rent, taxes and interest are not costs to the national economy, but transfers of income. Wages for outside labor can be counted only for a certain portion as a social cost in view of the assumption of underemployment. Depreciation of farm equipment has not been mentioned as a cost element, because it can be considered in the simple farm economy as covered by the sum of purchases of farm requisites.

All this means that the costs of farming for the economy in an underdeveloped area are reasonably well expressed in the expenses of the farmers for the purchase of requisites and the services of people that have been distracted from other economic activities. How large are these costs?

In this connection the reports included in a series published by the Economic Commission of Europe and FAO (4) are enlightening. The ECE/FAO report discloses that current operating expenses<sup>2)</sup> vary from 45% of gross output in the U.K. to only 8% in Greece. For the Netherlands the percentage is 25% and for Italy 17%. In underdeveloped areas the figure will probably be close to that mentioned for Greece. As a rule of thumb, to be used if no information is available, one could say that current expenses will be about 10% of gross output in underdeveloped areas where most of the labor is done by the farm family or by otherwise unemployed people.

---

<sup>2)</sup> Materials bought by farmers, plus fees paid for services, plus maintenance and depreciation.

It should also be kept in mind that we are really chiefly interested in the increase in costs due to the project and not in the absolute figures. The costs should increase less than proportionately with the increase in gross output because of the importance of fixed or overhead costs (most important of which is the value of the labor of the farm family).

This explains why one does not make a great mistake by disregarding farm costs while considering the significance of a project to the national economy. The margin of error in the estimate of gross benefits may well be larger than 10% and it will certainly become larger in the process of reducing gross benefits to net benefits as required for the calculation of the benefit/cost ratio.

Consequently it is the opinion of the writer that the capital/output ratio gives a reasonably correct indication of the economic feasibility of a project.

It will be understood that the lower the ratio the better the project. The question may arise however, of how high a ratio can still be accepted? In other words, where is the limit? Some projects have a ratio of 3 : 1, others 5 : 1, or even 8 : 1.

The answer to this question depends mainly on two factors: the rate of depreciation of the project, and the free market rate of interest for long-term loans.

A basic rule in judging investment projects should be that they should at least make good their real costs to the economy. It is clear that these costs will increase with the rate of depreciation and the rate of interest. Although the maximum acceptable capital/output ratio has to be established in each case anew, one will often find that the limit is a ratio of about 6 : 1.

These remarks should not be taken as an indication that the author does not see the importance of research in farm economics, especially in farm cost-accounting. To the contrary such research work should be pushed and every reliable piece of information should be used in the evaluation of a project. It should be realized that the time for detailed and refined economic analyses of land development projects has not yet come about, and that therefore a simple test should be used rather than a sophisticated one, for which there is not a sufficient basis of information. For most areas of the world it will be a long time before we have such a basis, and maybe we will never be able to analyse sufficiently the economics of peasant farming.

#### EFFECT ON FARM INCOME

Despite all that has been said about the difficulty of collecting reliable data on the costs of operating farms, it is nevertheless necessary to estimate the increase in farm costs in order to consider the effect of the project on the economy of the farm.

This consideration should be guided by the conviction that it is necessary for the speedy success of the project to get the wholehearted cooperation of the farmer, and that the best way to solicit this cooperation is to show him that his net earnings (in kind and money) will increase greatly as a result of the project.

In order to show this to the farmer one has to collect information on the probable increase in the expenses of the farmer. This increase in expenses will in many cases stem from larger purchases of fertilizers, insecticides, etc., expenses for machines, payments for the use of water, increased tax payments.

It will usually not be too difficult to collect the amount of information about this increase in current expenses that will enable the investigator to find out whether this increase will cut too large a portion out of the expected increase in gross output. The conclusion of some research work will usually be that costs will increase by only a fraction of the increase in gross income so that it can be expected that net income will increase rapidly and considerably. As mentioned above, part of the explanation of this phenomenon is that a large portion of the farm costs are non-monetized costs or non-variable costs.

#### EFFECT ON GOVERNMENT FINANCES

Governments, or specialized government agencies, are usually very much involved in the investments in an irrigation project. It is therefore legitimate to investigate whether the government receives a reasonable return on its investment. Moreover there are the costs of operating the project.

As a matter of principle farmers should be expected to reimburse the government for the capital and operating costs, although it may sometimes for social or political reasons be decided not to adhere to this principle.

The principle does, however, not imply that reimbursements ought to be made by way of a water charge. Part, or even all, of it may be collected in the form of general or special taxes.

No matter what the administrative arrangements are in any specific case one has to estimate the future increase in government income in the form of larger tax collections and of special rate collections resulting from the project. This estimate can be compared with the amount of government investment in order to establish whether there will be a reasonable return.

A second question to be considered is whether the farmers will be able to repay the government for the services provided in the project. This estimate of the repayment capacity of the farmers receives much attention in the U.S.A. and also in other regions (see 5). It is, however, of less importance in underdeveloped areas because the increase in gross value of production is relatively larger in those areas than in a well-developed country. It will appear that in most cases the repayment capacity is adequate if the project passes the two earlier tests (effect on the national economy, and effect on farm income).

#### ACKNOWLEDGEMENT

Although the author is a member of the staff of the International Bank, the opinions expressed in this article are his, and they do not necessarily represent the views of the Bank. The author wants to express his gratitude to those who read drafts of the article.

#### LITERATURE REFERENCES

##### A *Items marked in the text*

- 1 GADGIL, D. R. : Economic effects of irrigation. Gokhali Institute of Politics and Economics, 1948, page 172.
- 2 Multiple-Purpose River Basin Development. Part I. Manual of River Basin Planning, UN New York, 1955, page 33.
- 3 Proposed Practices for Economic Analysis of River Basin Projects. Prepared by the Sub-Committee on Benefits and Costs, Washington D.C., May 1950.
- 4 Output and Expenses of Agriculture. ECE/FAO Agri. 145.
- 5 Manual on Economic Development Projects. Prepared for ECLA, General E/CN. 12/426, 1957.

- 6 WEEKS, D. : Criteria for the evaluation of rural development projects and programs. *"Rivista di Economia Agraria"*, September 1955.
- 7 GLINSTRAL BLEEKER, R. J. P. VAN : Prioriteits bepaling van overheidsinvesteringen. (Establishing a priority rating for government investments). *De Economist* (Netherlands), December 1954.

**B Other items**

- 8 KAHN, R. F. : The relation of home investments to unemployment. *Economic Journal*, 1931, page 173.
- 9 KRÖLL, M. : Der "Multiplikator" anders gesehen. Wien, *Zeitschrift für National Ökonomie*, Band XVI, Heft 3-4, September 1956.
- 10 GOLZE, A. R. : Reclamation in the United States. 1st Edition, 1952, p. 129.
- 11 CLARK, C. : The Economics of Irrigation. New Commonwealth, November 25, 1954.
- 12 GRANT, E. C. : Principles of Engineering Economy. 3rd Edition, 1950.
- 13 Pakistan National Training Centre. Digest of Lectures, FAO, January 1956, p. 85 etc.
- 14 SOET, F. DE : Aanvullende werkgelegenheid. (Supplementary Employment Possibilities). Leiden, 1954, page 56.
- 15 KAHN, A. E. : Investment Criteria in Development Programs. *The Quarterly Journal of Economics*. February 1951, page 38.
- 16 CHENERY, H. B. : The Application of Investment Criteria. *The Quarterly Journal of Economics*, February 1953.
- 17 CIRIACY-WANTRUP, S. V. : Benefit-Cost Analysis and Public Resource Development. *Journal of Farm Economics*, November 1955, pp. 682 and 688.