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Arthur Weibring

3/13/51

Proposed Statement by the Bank's Observer at the Fifth Annual Meeting of the Transport and Communications Commission (ECOSOC)

TRANSPORT LOANS BY THE IBRD

This 5th Annual Meeting of the Transport and Communications Commission is being held at a time when the International Bank for Reconstruction and Development will soon be completing the first five years of its life. All of you may therefore be interested to learn about the Bank's concern with the development of transport facilities in its Member States.

Roughly 25% of all the lending by the IBRD to date has been for the rehabilitation, improvement, and expansion of means of transport in Member States. The Bank's total loans for all purposes through mid-March 1951 approximate $1.1 billion. Its loans to finance the purchase of means of transport alone approximate $264 million. They include loans to the combined amount of $94 million for specific transport projects in Ethiopia, India, Luxembourg, the Netherlands, Thailand, Turkey, and the Union of South Africa, and expenditures or allocations for transport equipment and materials to the combined amount of almost $170 million from the proceeds of loans to Australia, Denmark, France, and the Netherlands. All of this $264 million has been lent or committed to cover the foreign exchange costs, mainly in U.S. dollars, of projects and programs involving large expenditures of both foreign exchange and local currency. All but a minor fraction has gone to cover the purchase price of transport equipment and materials bought abroad; most of the remainder has paid for the ocean haulage of such imports; and a small balance is being used to pay the salaries of foreign technicians.

These, however, are mere aggregate figures of IBRD financing. They show, to be sure, that the Bank has made sizable transport loans, and that transport loans are a good fraction of the Bank's total work. What they fail to bring out is the specific usefulness of these loans, their rich diversity and broad range of purpose. This can best be understood by reviewing them individually.

The Bank's lending activities began in the summer of 1947 with a series of loans to speed the economic recovery of war-hit Europe. France borrowed $250 million toward this end, the Netherlands $195 million, and Denmark $40 million. The common purpose of all three loans was reconstruction and development in the broad sense of restoring overall capacity and increasing overall output. The entire proceeds, amounting to $485 million, were thus spent on imports of equipment and materials to re-activate vital productive facilities or to keep them running at a higher tempo. About a third of the disbursement, or $162 million, went for imports of transport equipment and materials in particular; i.e. $86.5 million out of $250 million borrowed by France; $66.7 million out of $195 million borrowed by the Netherlands, and $8.3 million out of $40 million borrowed by Denmark. The pattern of imports varied, of course, with the specific circumstances of each borrowing country's recovery effort. France bought merchant vessels for her ocean fleet, diesel-electric locomotives for her railroads, civilian aircraft for overseas service, and coal and oil for transport use. The Netherlands bought ships, shipyard facilities, motor vehicles, aircraft and miscellaneous materiel such as steel for bridges. Denmark bought shipbuilding, automotive, and radar equipment.

The great bulk of the Bank's transport lending since these general purpose loans has been for transport projects in a strict sense. The first

such project loan was to Luxembourg in late August 1947. It formed part of a $12 million credit to Luxembourg of which $4.3 million went for the purchase of railway motive power and rolling stock to replace equipment destroyed or worn out during the war. The major benefit from this Bank-financed equipment was a considerable strengthening of the Luxembourg Railways as a vital adjunct of the country's heavy industry and agriculture and as international carriers linking the Ruhr, the Saar, Lorraine, Switzerland, and other inland areas with the Low Country ports.

In June 1948, the Bank made its second loan for a specific transport project by advancing $12 million to various Dutch shipowners for the purchase of merchant vessels. The Netherlands at that time was making an all-out effort to restore her ocean fleet in the hope of thus re-establishing a major source of foreign exchange income. She needed all the new ships she could get as quickly as they could be had. Half a dozen vessels became available in the United States at a bargain price of $2 million each. The Bank was asked to lend, and did lend, the full purchase price of all six ships. In each case, the borrower was a Dutch shipowner, and in each case the credit was fully guaranteed by the Netherlands Government and additionally secured by a ship mortgage. Thanks to the Bank's intervention, the Dutch merchant marine was enlarged by new capital assets which have since been earning and saving substantial amounts of foreign exchange over and above all service of the debt.

In August 1949, came the largest of the Bank's loans for any single transport project to date. This was a $32.8 million credit to India for providing the State-owned Indian Railways with additional motive power. Mainly because of the lack of enough locomotives, the Indian Railways

were seriously congested in 1948-49, could not move grain, coal, ore, textiles, and other essential goods promptly, and had to apply restrictive priorities on the haulage of freight. In order to relieve this critical shortage of motive power, large orders for new locomotives were placed in the U.S.A., Canada, and Europe. Since India had insufficient means in hard currency to finance all the engines on order with U.S.A. and Canadian builders, she turned to the Bank for the necessary aid. The Bank granted that aid, thus facilitating a prompt expansion in tractive capacity, thanks to which the Indian Railways are presently moving without priorities a much larger volume of essential goods than in 1948/49.

In June 1950, the Bank made its first loan for a port project by advancing $12.5 million to Turkey to cover the foreign exchange costs of a 5-year program of improving, expanding, and modernizing the main Turkish ports. Turkey's economic growth has long been hampered by inadequate port facilities which make it costly to handle export, import, and coastal cargo. With better ports and thus lower costs of production, Turkey could increase the volume of her external and inter-regional trade, earn more foreign exchange from her exports, and pay less foreign exchange for her imports. The program of port construction and development which the Bank is now financing, will help to realize these benefits by equipping Turkey with [illegible] efficient facilities for servicing ships and handling cargo at Samsun on the Black Sea, Salipazar and Haydarpasa in the Istanbul area, Izmir on the Aegean, and Iskenderun on the Mediterranean. In several instances, the Bank-financed port facilities will service grain elevators also financed by the Bank.

In August 1950, the Commonwealth of Australia borrowed $100 million from the Bank to finance imports of capital goods and equipment needed for

development projects in Australia, both private and governmental, over a 2-year period. Part of the proceeds will be spent on railway equipment such as diesel-electric locomotives, and rail cars. The Bank-financed imports of railway equipment are expected to total $8 million.

In September 1950, the Bank's field of transport lending widened further with a $5 million highway loan to Ethiopia, our first financing of a road project to date. Although Ethiopia is an underdeveloped country, she has a nation-wide network of main roads along which most of her internal trade and part of her foreign trade is truck-hauled. These roads are badly run down, however, and require prompt rehabilitation as one of the most urgent of Ethiopia's developmental needs. In order to accomplish this task, the Ethiopian Government is setting up a national highway authority, whose foreign exchange costs for equipment, materials, and salaries will be covered for an initial period of 3 years out of the proceeds of the Bank loan.

The most recent of the Bank's transport loans have been to Thailand, last October, and to the Union of South Africa, this January. Thailand is borrowing $4.4 million for development of the port of Bangkok and $3.0 million for rehabilitation of the Royal State Railways. The Union of South Africa is borrowing $20 million to expand and improve the State-owned transport facilities operated by the South African Railways and Harbours Administration.

Thailand needs better rail and port facilities mainly because those she has at present are a serious barrier to expanding her inter-regional trade as well as her exports of rice, rubber, tin, and teak. The railway loan will provide much-needed spare parts for rolling stock, signalling equipment for traffic control, and repair shop equipment for the overhaul

of engines and wagons. The port of Bangkok loan will finance the dredging of a new channel and the purchase of new port equipment. Because of the rapid economic growth of the Union of South Africa in the past 10 years, her railroad, motor, and air transport facilities are being seriously overstrained. South African Railways and Harbours, which is responsible for all these services, is therefore pushing ahead with a 6-year program of renewals, betterments, and expansion. The loan from the Bank will help to pay for part of the imported equipment, particularly railway motive power and rolling stock.

As the record of our actual performance shows, all of the Bank's transport loans are inspired by a common purpose: better railways, ports, roads, and the like, not for their own sake, but as tools of increased production, expanded trade, and higher standards of living. All types of transport facilities which help to maximize production, trade, and standards of living are thus suitable for Bank lending, provided that the projects in question are submitted by a creditworthy borrowing State, that they would not impose excessive external debt on the borrower, or overstrain its internal finances, and that the engineering and commercial phases have been well thought out. These are the same broad criteria which the Bank applies to every kind of project it is asked to finance regardless of whether the field of productive activity be the direct production of goods, their haulage and handling, or power supply, irrigation works, and other indirect means of stimulating output.

Our general procedure in applying these criteria is briefly as follows:

(i) We assess the borrower's creditworthiness in the context of the country's overall economic and financial position and policies and the expected long-range direct and indirect impact of the project on its balance of payments.

(ii) We appraise the urgency and productivity of the project within a framework of priorities as defined by the overall economic and development patterns of the borrowing country.

(iii) We establish the availability of local financing for the project in the light of the country's total financing needs for high-priority investment.

(iv) We determine the economic soundness of the project and the thoroughness of its engineering.

In considering a transport project against the background of these criteria, especially from the viewpoint of priorities, we ask the following specific questions among others:

Will it help to increase the production of particular goods?

Will it help to break some bottleneck to the world supply of essential materials?

Will it promote regional economic growth by facilitating inter-regional trade?

Will it open up new productive areas which are underdeveloped for want of access to markets?

Understandably, we are also concerned with measuring the benefits to be had from better transport against the investment cost of providing the necessary facilities. We construe these benefits, however, in a much broader sense than commercial return on the investment as measured by operating revenue, working expenses, debt burden, depreciation, and similar yardsticks. Clearly, except in special circumstances, means of transport ought to pay their own way like any other productive facility. Yet they are primarily a form of social overhead capital the most significant returns from which are an increased output of essential goods for internal and ex-

ternal trade. The most important yardstick is thus how better transport will react on productive potential, real income, interchange of goods, and standards of living.

To date, as our lending performance indicates, there has been a substantial volume of suitable transport projects for Bank financing. What, however, is the immediate outlook? We foresee an increasing demand from our Member States the world over for still more loans to improve their railways, road networks, ports, merchant fleets, inland waterways, and the like. We foresee an increasing demand mainly because programs of transport investment are a sine qua non for developing the agricultural, mineral, and industrial resources of underdeveloped countries. We are eager to do all that we can within the means of our disposal and subject to the availability of equipment and materials, to carry out these programs.

Table 1 - IBRD loans for transport equipment and materials through March 15, 1951

- Amount in million dollars -

Borrowing Country	Total	Project loans for specific transport projects	Transport materiel from proceeds of other loans
Australia	8.0	-	8.0
France	86.5	-	86.5
Netherlands	78.7	12.0	66.7
India	32.8	32.8	-
South Africa	20.0	20.0	-
Turkey	12.5	12.5	-
Denmark	8.3	-	8.3
Thailand	7.4	7.4	-
Ethiopia	5.0	5.0	-
Luxembourg	4.3	4.3	-
Total	263.5	94.0	169.5

Table 2 - Means of transport financed by IBRD loans for transport projects

Borrowing Country	Date of loan Agreement	Broad purpose	Amount in $000
India	Aug. 18, 1949	Additional motive power for State-owned railways	32,800
Luxembourg	Aug. 28, 1947	Railway facilities	4,300
Netherlands	July 15, 1948	Purchase of merchant vessels by Dutch shipowners	12,000
Ethiopia	Sep. 13, 1950	Rehabilitation and maintenance of road network	5,000
South Africa	Jan. 23, 1951	Expansion of State-owned railways, road services, and air services	20,000
Thailand	Oct. 27, 1950	Rehabilitation of State-owned railways	3,000
Thailand	Oct. 27, 1950	Development of port of Bangkok	4,400
Turkey	July 7, 1950	Construction, equipment, and modernization of ports	12,500
	Total		94,000

Table 3 - Means of transport financed out of general reconstruction and development loans

Measure	Total	Netherlands a/	France b/	Denmark c/	Australia d/
Proceeds spent or allocated on all equipment and materials	-	195.0	250.0	40.0	100.0
Proceeds spent or allocated on transport equipment and materials	169.5	66.7	86.5	8.3	8.0 e/
Merchant vessels	57.5	40.2	17.3	-	-
Locomotives, freight cars and other railway equipment	5.2	-	5.2	-	-
Shipbuilding facilities	6.5	3.2	-	3.3	-
Automotive equipment	8.6	4.0	-	4.6	-
Aircraft and parts	12.3	6.3	6.0	-	-
Miscellaneous transport materiel f/	13.0	13.0	-	-	-
Coal and oil for transport use	57.9	-	57.9	-	-
Railway equipment in general	8.0	-	-	-	8.0 e/
Radar equipment	0.4	-	-	0.4	-

a/ Loan agreements dated August 7, 1947 and May 25, 1948
b/ Loan agreement dated May 9, 1947
c/ Loan agreement dated August 22, 1947
d/ Loan agreement dated Aug. 22, 1950
e/ Provisional allocation for transport equipment
f/ Such as bridges

AW:mm

UNITED NATIONS
ECONOMIC
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SOCIAL COUNCIL

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WORKING PARTY ON ECONOMIC DEVELOPMENT AND PLANNING

Sixth session : Transport Development in Economic Development and Planning

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ECONOMIC CRITERIA FOR ASSESSING TRANSPORT PROJECTS

Working paper for provisional agenda item 6 (d)

Prepared by

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ECONOMIC CRITERIA FOR ASSESSING TRANSPORT PROJECTS

1. This note is concerned with the appraisal of transport projects with a view to determining their economic soundness. It goes without saying that no transport project can be a sound investment, whatever its economic merits, unless it is also technically, financially and administratively sound. The following discussion deals only with the general criteria that should be considered in making the economic appraisal.

2. For the purposes of this note, a transport project is one for the construction (or major rehabilitation) of railways, roads, ports, inland waterways or airfields, including usually the procurement of transport on handling equipment, and terminal and other ancillary facilities. Such a project is appraised economically in the light of: (a) its investment cost to the national economy; (b) the resulting benefits to the national economy; and (c) the adequacy of the benefits in relation to the cost.

Cost to National Economy

3. Evaluating the investment cost to the national economy is more than an arithmetical exercise. Realistic cost estimates of the project itself, prepared by competent engineers, are an indispensable first step. However, (a) it may be impossible to realize the potential benefits of the project without substantial investment in other transport facilities which are not part of the project, and/or (b) the investment in the project and related transport facilities may be part of a larger investment for productive facilities or social overhead capital, or both.

4. A common type of project is one for investment by a government, a municipality, or a public authority, in the construction of roads, railway lines, ports, airfields or inland waterways. Before such public investment can realize its full usefulness, it must usually be supplemented by private investment for the provision of additional facilities and equipment such as, for example, trucks and buses, specialized rolling stock, aircraft, freight and passenger vessels, or cargo-handling equipment, as the case may be. The project cost alone is therefore only a partial measure of the cost to the national economy; what is needed is the total outlay for transport facilities. This can be estimated in most cases within acceptable margins of error.

/5. Frequently

5. Frequently the project under consideration will be a developmental one in the sense that the transport facility gives access to a new mine or manufacturing plant or opens up a new productive region. The cost/benefit analysis is very simple where, for example, a specific railroad or port, or both, are to be built as part of the development of an iron ore or manganese deposit or of an aluminium or fertilizer plant. In such a case, the transport facility is a direct adjunct of the industrial facility; there is no separate transport project as such, but instead a transport component of an industrial project, and the economic appraisal is based on the economic cost and economic benefits of the project as a whole.

6. Complicated problems of a conceptual nature may arise where, for example, a road or railway is to be built or a river made navigable to open a new region whose productive potential is not utilized or under-utilized because of lack of transport. In such cases, the cost of building the railroad or highway, or of making the river navigable, is one element of a larger complex of public and private investment for such things as farms, grain silos, food processing plants, brick works, irrigation canals, etc., for social overhead capital such as housing, schools, water supply, hospitals, etc., and for transport facilities including the new route, plus the needed vehicles, handling equipment and terminal facilities not part of the project. Where transport projects are a mere adjunct of regional development, they should not be credited with the full potential benefits from a total investment which ordinarily would amount to many times the cost of the railroad plus its rolling stock, or of the highway plus its fleet of motor vehicles. Some crude approximation of the total investment has to be worked out, and some reasonable assumptions have to be made for imputing a proper share of the benefits to the transport facilities.

7. Artificial exchange rates are another complicating factor, since they distort the true (present) costs of the project and are an unreliable basis for assessing its true (future) benefits and debt burden. For example, governments which use multiple exchange rates as an instrument of trade policy sometimes allot foreign exchange - for imported goods and services - to their State Railroads, highway departments, port administrations, canal authorities, etc., at much cheaper rates than those granted to exporters on the proceeds of their sales abroad. The nominal cost of the project in such cases will differ from its cost to the national economy by the amount of the indirect subsidy, and there will be a material understatement of the cost of the project in terms of future debt service on funds borrowed abroad. Allowance should be made for these factors.

/8. Finally,

8. Finally, various technical adjustments are necessary to establish even nominal costs. Proper allowance must be made for interest during construction and for surveys, design and supervision; for pre-construction research and planning costs; and for labour, price and foreign exchange contingencies during the construction period. Part of the cost of some works which must be built all at once, if they are to be useful at all, may have to be treated as a deferred cost of future traffic, e.g., breakwaters for a port which will be expanded in successive phases, or the roadbed of highways which will be built by stage construction.

Benefits to National Economy

9. Every transport project yields its own type and amount of economic benefits. The nature, incidence and timing of such benefits will differ with the type of project as, for example, between an inland waterway system in Western Europe, a railway in Latin America or Africa, a port in the Middle East, or a road in South-east Asia or Central America. The benefits from transport projects can nevertheless be classified in several broad groups, some of which overlap others.

10. New transport facilities can and do induce production for market by opening up new areas, by stimulating farm-to-market, interregional and foreign trade, by promoting a shift from subsistence to cash-crop agriculture, or by serving as an essential adjunct of new plants and mines. The addition to the national income in each case can be computed, and reasonable assumptions should be made by which to allocate a proper share of these benefits to the project.

11. Transport facilities can and do reduce costs of inland haulage, cargo handling, ocean and air carriage, i.e., enable given amounts of traffic to be carried or worked at less cost per ton or TKm, per passenger or PKm. It is the real cost savings of labour, materials and equipment which have to be assessed. This is no easy task, since the nominal costs may not give proper weight to depreciation or interest charges, may be distorted by direct or indirect subsidies to particular means of transport, or may reflect charges for social welfare and national defence which are extraneous to transport.

/12. Transport

12. Transport facilities can and do save time, reduce or eliminate waste, diminish fatal accidents and property damage. Such benefits can be assessed by various measures, e.g., interest savings on the reduction in needed inventories for a given amount of trade; the market value of perishables safeguarded from spoilage, infestation or rodents; lower insurance premiums for third-party liability and for casualty losses. The entire gain in such cases is properly attributable to the transport project alone; little or no other investment will be needed, as a rule, to realize the full benefits.

13. Transport facilities can and do result in higher prices to producers, lower market prices for consumers, wider profit margins for carriers and handlers, larger tax yields to the government and municipal entities. They thereby affect personal and corporate income, family finances and government revenue in ways which tend, by and large, to stimulate production and to increase standards of living.

14. Finally, transport projects can and do facilitate better town planning, the relocation of industry and agriculture, and the decongestion of heavily built-up areas. These benefits are the most difficult of all to evaluate, but are often very important reasons for executing a project.

15. It is clear that computing the costs and benefits of transport projects is neither a simple nor a clear-cut procedure. Nevertheless, the analysis has to be made; otherwise there would be no economic criteria at all, and every transport project would have to be regarded as being as good as any other.

Adequacy of Economic Benefits in Relation to Cost

16. The last problem is to determine whether the project promises to yield an adequate economic return. This is by no means equivalent to evaluating its investment return to the transport enterprise (if any) charged with the capital cost. The forecasted earnings out of revenue from a new railway line, toll road, port, or airfield, may be inadequate for reasons extraneous to the usefulness of the project to the national economy; e.g., inefficient organization and management of the transport enterprise; rate-making restrictions imposed by the government; social insurance laws tending to inflate labour costs; a government policy of pricing transport services so as to subsidize heavy industry, basic agriculture, particular productive regions, or particular economic groups. In all these cases,

/there should

there should be an investigation whether through appropriate policies, the financial return to the enterprise can be raised in order to avoid it becoming a financial drain on the rest of the economy.

17. There are no self-evident or indisputable reasons for holding that the economic return on a project is adequate because it equals or exceeds some particular rate, such as yields on mortgages, bonds or shares in the country concerned, the profits earned by private enterprises, the cost to the government of borrowing funds at home or abroad, the productivity of investment in other sectors of the economy, or even the economic return on similar transport facilities elsewhere in the world.

18. The nature of the benefits, not merely their amount, has to be considered. For example, railways, roads or ports tending to stimulate production for export might rightfully be given priority over transport projects yielding internal benefits in countries where small export volume is the main obstacle to development. An under-developed country under acute, lasting balance-of-payments pressure might rightfully choose to invest, as between expanding its rail network or building new highways, in the alternative which will require the smallest ultimate expenditure of foreign exchange for vehicles and parts, fuels and supplies, interest and amortization. Individual governments will give different weight for good and sufficient reasons to such diverse benefits from transport projects as increased realization prices for producers, larger profit margins for carriers, or higher standards of living for low-income groups.

19. Thus, there is no ready, fixed formula for assessing the adequacy of the economic return from transport projects. As a rough-and-ready answer, the new facilities should be able to yield a sum of economic benefits over their useful life equal to or larger than their original cost plus reasonable return. The principle is clear, but its application to particular cases will be affected by complicating factors such as the value which a particular society assigns to future benefits compared with current costs, and a desire to distribute income in a given way among industries, regions and groups or to use means of transport for realizing non-economic objectives of public policy.

/20. It is

20. It is difficult in all cases (and may be impossible in some) to decide whether a given return is economically adequate. However, the return itself can be calculated if the full project costs are known and if the imputable benefits are such as lend themselves to measurement.

21. Each project will consist of particular facilities with a definite useful service life; the annual benefits, taken over the average useful life, will work out at a definite yield on the project cost, and this yield - whether 10 or 15 per cent annually, or any other figure - can be compared with, e.g., the economic return of other developmental investment.

October 12, 1962

PROJECT APPRAISAL

Industry Division Staff

International Bank for Reconstruction and Development

Washington 25, D. C.

INTRODUCTION

In sixteen years of operations, the International Bank for Reconstruction and Development has loaned slightly more than $6.5 billion equivalent to its members. Of this amount, nearly $900 million equivalent have been for direct loans to expand existing industries or to establish new manufacturing and mining industries.

As a matter of policy, Bank loans for industrial projects are made to private borrowers on conventional terms, at the going interest rate (at present 5½%) for periods usually not exceeding 15 years. Government may, in some cases, have a share of the company, but the control of the operations must be left in the hands of the private investors.

A detailed appraisal of a project is an important part of the Bank's procedure in dealing with loan applications. Similarly, project appraisal or evaluation should be an important part in general planning and programing for industrial development.

Proper programing with a view to the achievement of economic objectives is, in most cases, a necessity for the process of rational economic development. Many cases can be cited where careful planning has resulted in significant and balanced growth of the economy. Cases can also be cited where lack of planning has permitted relative stagnation or distorted and uneconomic development. There is little doubt of the

need for overall planning, although detailed programing of some sectors often presents problems. The industrial sector is, perhaps, of all the sectors of an economy, the most difficult to plan, especially where private enterprise is important.

One of the most beneficial aspects of planning in the industrial sector, in many cases, is the creation of an environment by the establishment of policies that take into account special labor or raw materials situations, tariff policies, credit facilities, etc., which will stimulate industrial development and growth. At the same time, there is a danger that specific and detailed programing and target setting for industries may overlook opportunities for productive investment that an entrepreneur with a special skill may see. Also, there is a further danger that a program or target may be used in such rigid terms, it may become an obstacle standing in the way of new, more economic investment opportunities as they arise.

This paper does not attempt to deal with industrial planning or programing in the broad sense. Instead, it is confined to a description of the techniques of project appraisal, the information required to permit an appraisal and the factors which are considered in any appraisal made by the Bank in the hope that such information will be of use by those engaged in planning for industrial development.

GENERAL APPROACH TO APPRAISAL

Our experience has taught us never to take anything for granted, and that we must be skeptical in appraising projects. Many times even the basic statistical data must be questioned in order to determine the

magnitude of error. All too often sophisticated techniques of mathematical analyses are applied to highly questionable data. While the results appear to be very precise they can in fact contain margins of error which could unduly influence the apparent feasibility of a project.

We have also found that each project must be considered on its own merits, that industry averages cannot safely be applied to individual projects, other than serving as a preliminary guide, and that formulas cannot be rigidly applied in such matters as the debt/equity ratio, current ratio, or other financial indicators.

In appraising a project, we in the Bank do not take the relatively narrow viewpoint of a conventional creditor. We do expect to be repaid on time of course, but equally important we are interested in the execution of the project and in its successful operation to the maximum benefit of the economy it is intended to serve. We therefore do not confine our scrutiny to the project itself, but are interested in all the circumstances surrounding it, the whole economic complex of which the project will form a part. In practice, this means that we investigate six different aspects of the project, namely: the economic aspect, the technical aspect, the managerial aspect, the organizational aspect, the commercial aspect, and the financial aspect. In particular cases there may be other aspects, such as legal, political, international, etc. which may also require careful consideration.

THE ECONOMIC ASPECT OF PROJECT APPRAISAL

Relative Priorities of Different Types of Projects

Before we can consider the merits of a particular project, our economists must first study the whole economy of the country involved and form conclusions about the relative priorities for development of different sectors of economic activity. In many countries in which we work, it is evident that the highest priority should be given to what is called the infrastructure of the economy, and the development of the basic services such as transportation and power; agricultural activities of course rank high in almost every country. Once these sectors have been developed to a certain extent, light industry may become important and, when light industry has reached a certain level of development it may provide a basis for heavy industry.

Once it has been established that a project is of a type that has a high priority, the question which the economist asks is this -- What is the need for the goods and services this particular project is designed to produce? This question must be answered from a broad point of view. One has to investigate not only the potential demand for the goods and services in question, its direct contribution to economic development, but also the indirect benefits that may be expected from it.

Market Studies

In order to answer the narrow question of the needs for goods and services of the particular project, a study of the market is required, the magnitude of which may vary widely. If one is looking at a brick factory for example, it is obvious that the cost of transportation limits the market area so that no extensive market survey is needed. But in the case of

drugs, cameras or transistor radios, where transportation costs are low in relation to the value of the product, one may have to make a much wider market study. Or if, for instance, the project is for the exploitation of a desposit of iron ore, it may be necessary to look at the whole world market, to form a judgment about the present and prospective future relation of demand to supply and so to come to a conclusion about the probable future price trends.

The market study may not be confined to one commodity. For example, in considering the demand for copper one has to take into account the prospect of competition with other materials such as aluminum and plastics which may be substituted for copper for certain uses.

Subsidy and Protection

Another aspect of the economic appraisal of projects is the question of subsidy or protection. In principle, it is likely a misdirection of investments and a waste of scarce capital resources to create an industry which can only be profitable if it is protected by a large import duty or by a quantitative restriction of imports. This is not to say, of course, that a certain amount of protection may not be justified in particular cases. Many of you are no doubt familiar with the classical "infant industry" argument, which makes the case for the protection of an industry in its earlier stages, if there is a true prospect of the industry being able to stand on its own feet without protection when it is well established and within a reasonably short period. But in principle, the moment it is found that an existing or proposed industry needs a high degree of protection to operate profitably, there is a prima facia case that this industry may not be the right choice, from an economic point of view, for the investment of scarce capital.

Relative Scarcity of Factors of Production

There is another aspect that the economist has to take into account -- the relative scarcity of the factors of production. It may be, for instance, that in certain countries population has grown or is growing at a faster rate than the opportunities for productive work. Labor in consequence is cheap. Very often in the same countries capital is scarce and its price high. In these circumstances, the creation of an industry which is labor intensive, which will provide many new jobs, has an economic advantage, other things being equal, over the investment of the same amount of money in an industry which is capital intensive, and which provides far fewer opportunities for new jobs.

This does not imply however an excuse to "make work" in an industry which by nature is capital intensive. There are examples where in continuous processes labor has been used to replace materials handling equipment. In some cases this has disrupted the continuous and orderly operation of the process, making the cost of the final product more expensive than if the so called cheap labor had not been used.

It is not only labor that can be unemployed. Natural resources may also be idle, and in this case it is generally economically advantageous to create an industry that puts these idle resources to use rather than one which depends on imported raw materials, with all the uncertainties that are involved in such dependency.

Indirect Benefits

As mentioned earlier, the project has to be looked at in all its relations to other economic activities. This means that indirect benefits to be expected from the project have to be taken into account. The

establishment of a particular project may give opportunities which did not before exist for the creation of related enterprises, perhaps supplying components, raw materials, perhaps for further processing of its products. The obverse of this is the question whether the project can be successfully carried out only on the condition that other developments which are not directly a part of the project are also carried out (for instance, the establishment or expansion of a steel industry is practical only if adequate arrangements are assured to supply the necessary raw materials and if there are adequate facilities to transport the raw materials and the finished products).

Effects on Balance of Payments

It is necessary to take into account the effect which the project is expected to have on the balance of payments -- either by way of generating exports or by way of substituting for imports. In forming an opinion on this question it is necessary to consider the need to import on a continuing basis raw materials, fuel, spare parts, and the repayment of foreign debt.

The Timing of Projects

The last point concerning the economic aspects of project appraisal concerns the question of timing. For example, it may be quite true that looking into the future, one may see that a certain scale of a project will be justified by the market demand in fifteen or twenty years times, but the investment of scarce capital will seldom be justified in a project when some of that capital will not be productive for many years to come. It would not matter if capital were so plentiful that it would earn practically nothing if put to other uses. But in almost all under-developed

countries the investment needs are so great that it is essential that the scarce capital available is invested in projects which can, in as short a time as possible, make a reasonable return on the investment so that funds may be generated for investment in other high priority projects.

THE TECHNICAL ASPECT OF PROJECT APPRAISAL

Scale of Operations

The first technical consideration to be studied is whether the proposed scale of operations is justified. There are certain industries which can work economically only at a certain minimum scale and to establish such an industry on a more restricted scale is a misdirection of scarce capital. The minimum scale varies greatly of course between different industries and between different countries. Usually it is the most capital intensive industries in which the minimum economic scale is large. But the proposed scale of a project must be looked at not only from the point of view of technical efficiency and of reducing costs of production, it must also be related to the prospective demand for its product. And here again the question comes up, how far ahead should we plan, how far ahead can we afford to build?

Operational Techniques

An investigation must be made into the proposed methods and processes to be used. In a type of activity in which rapid technological progress is being made and new and improved processes and equipment are being developed, one has to be careful to take account of possible technological obsolescence. In Europe and the United States today for example, no company will invest in a plant for certain types of chemical manufacture

unless there is a reasonable prospect that the total investment of the plant can be returned within two to five years. This of course is an extreme case in an industry in which technological improvement is occurring very rapidly. But even in the older established industries one cannot be sure that new developments will not change the industry almost over night. As an example, one has only to look at the developments in the steel industry during the last few years. Blast furnace techniques, long considered unimprovable, have changed radically in a short time so that output of a given furnace can be nearly doubled with relatively minor investments.

Plant Layout and Location

The layout of a project may be very important, especially from the point of view of possible future expansion. Otherwise, when the time comes for expansion efficiency may be reduced due to bottlenecks in the flow of production from one process to another, and the whole problem of internal transportation may throttle expansion beyond a certain point. This is an example where it may be very profitable to spend more money now in order to save at a later stage. If in the future more land will be needed to expand the factory it may be better to buy it now and leave enough room in planning the layout of the buildings in order that additional units may be added later.

Account must be taken of the relation of the proposed location to the sources of the raw materials and other factors of production, and to the markets to be served by the project. The sources of power, of fuel, of skilled and unskilled labor all have to be considered in this connection. There may be advantages in locating near a large city, where public utilities are available, and housing for workers presents no problem. But

in some projects, the economics of the case demand that the project be set up close to the sources of raw materials, and then it may be necessary to include in the project the whole cost of building a town, with all the housing, schools and utilities involved.

There is an additional factor which has to be taken into account. Sometimes an outside authority will have to build the road or railway branch leading to the project, or a transmission line bringing power to the site, and one has to be sure that arrangements have been made for these works, and that the progress of this kind of work is coordinated with the needs of the project.

Need for Consultants

The investigation of the proposed arrangements for carrying out the engineering of the project is an important part of the technical appraisal. Are the sponsors of the project themselves capable of doing their own engineering work or will they need help, for instance, from an engineering consultant? One may often find that a factory maintains a very competent engineering department which is fully capable of understanding and solving the problems of production and maintenance, but which is not qualified to carry out all the engineering tasks required for the design and construction of the proposed expansion of the factory. The amount of work consultants may be needed for varies greatly from project to project. It may run from the design of the plant, the preparation of specifications and invitations to bid, the analysis of bids and the recommendation of which bidder the contract should be awarded to, the inspection of equipment purchased, arrangements for shipping and insuring imported

equipment, the supervision of construction and installation, as well as to the initial control of operations of the completed project. Consultants cost money but their services frequently save many times their cost.

Construction Schedule

The timing of construction must be realistically planned. This involves the careful scrutiny for all the different main physical elements of the project, of a construction schedule which takes all the necessary steps into consideration, from the engineering design work to the installation and testing of equipment, taking into account the effect of seasonal or other unusual variations in working conditions.

Cost Estimates for Construction and Operation

Parallel to the construction schedule there must be a budget in which the estimated cost is calculated for all the different phases of construction and for all the main physical elements of the project. The investigation of the construction and operational cost estimates must start with an examination of the assumptions on which the cost estimates have been based. The cost estimate must include adequate allowances for physical contingencies and for likely increases in the general level of costs during the construction period. It may be necessary to include the cost of interest on borrowed funds during the construction period. In addition, an adequate allowance must be made for the initial working capital requirements. It is necessary to check carefully that all costs associated with the project are included and it is well to remember very few projects proceed according to schedule. In reviewing cost estimates one has always to be on the pessimistic side and to provide something to

take care of the delays and accidents and changes in design and unfavorable movement of prices.

It is useful of course to compare the estimated costs with the actual costs of other similar projects, and if there are any major discrepancies to find out their cause. The costs of operation need to be investigated for different levels of production. Many sponsors expect that they will be able to produce at capacity from the moment the plant starts up. This is seldom if ever true and adequate allowances must be included for the start-up expenses and the training of the labor crews.

THE MANAGERIAL ASPECTS OF PROJECT APPRAISAL

The appraisal of management presents peculiar difficulties. Of course, where a project is to be carried out by an existing organization much can be learned about the quality of management from a study of what has happened in the past. But it often happens that a management with a good past record may be inadequate to handle a greatly expanded operation. In particular proper delegation of authority is sometimes difficult to obtain, and this may be due not only to unwillingness to delegate from the top but also due to lack of executive ability on a second level.

The shortage of management experience and ability is one of the main difficulties standing in the way of economic development in many countries. It is in some cases compounded by an unwillingness to employ foreigners in positions of management responsibility. One solution to this problem may be the partnership between local investors and an existing foreign organization. Another possibility is to have professional managing agents provide centralized management services for a number of different organizations.

There are, however, cases in which these solutions may not be practical, and in which the only reasonable assurance of adequate management is to import it. It may be possible to arrange for a management contract with a foreign organization, or it may be practical to employ individuals from abroad. One of the objectives of such arrangements should be that the foreigners train local people to take their places as soon as practicable.

One difficulty frequently met with is the limited concept of the role of management in some countries, where it is not understood that management is more than simply keeping a plant running. In general, the appraisal of management is "an art and not a science," and the investigator has to rely on his personal judgment, based upon his own experience of men and affairs. One word of caution is in place here: any project which depends for its success on a one-man management is a risky affair, and one should try to find a way to minimize that risk.

THE ORGANIZATIONAL ASPECTS OF PROJECT APPRAISAL

This side of the appraisal of a project falls naturally into two phases, the organization required to bring a project to the operating stage and the organization required thereafter. The type of problem which has to be investigated here is the extent to which responsibility and authority should be centralized or delegated. This, of course, is intimately related to the scale of operations, and to their geographical extension.

One of the most important aspects or organization is the question of adequate internal controls. In order for management to be able to function efficiently, an organization must be able to provide without delay

intelligently presented information which is constantly checking performance against expectations and so bringing to light problems as they arise. It is, of course, equally important that an organization should be able to put the decisions of management into practice without undue delay.

Another aspect of organization is the importance of good budget controls and the system of controlling inventories. These in turn are closely connected with the system of controlling and scheduling production, which in its turn must be dovetailed into a regular schedule of routine and preventive maintenance. The necessity for preventitive maintenance cannot be stressed too strongly because in our experience its importance is not properly appreciated in many of the developing countries.

A final point on the organization aspect is the question of training. Arrangements must be satisfactory for training at all levels in the organization, from apprentices to management candidates, in making plans for a project. The training aspect is of the utmost importance where a new industry is to be established in a country in which there is little or no previous experience in the field. It is of little use to build a plant if one cannot be assured that the necessary skilled personnel will be available to operate it when the physical plant is completed.

THE COMMERCIAL ASPECTS OF PROJECT APPRAISAL

By the commercial aspects of appraisal is meant the investigation of the arrangements for buying the materials needed to construct the project and the arrangements for obtaining the raw materials, power and labor for the operation of the project, and for marketing its product.

In the construction phase, the main objective is to see that the proposed arrangements will ensure that the best value is obtained for the

money spent. This will normally mean that the arrangements should provide effect competition between potential suppliers and contractors. The best way to ensure this is usually through international competitive bidding. It is, of course, true that there are exceptions to this. For example, it may be most economic to standardize on the basis of existing equipment in order to reduce both the investment in spare parts and the cost of maintenance. Sometimes competition between suppliers may not be appropriate, as in the case of manufacturing under license. It is necessary to investigate whether those responsible for the project have the necessary knowledge and experience to come to the best decisions about the way in which the available money is to be spent. In many cases, they need outside help for this purpose which can be provided by consultants.

The investigation at the operating stage involves the proposed arrangements for obtaining raw materials, power, etc. and for marketing products of the project. Among other things, this will involve investigation of the terms of purchase and sale, which will have an important bearing on the amount of working capital required.

THE FINANCIAL ASPECTS OF PROJECT APPRAISAL

All of the information gathered under the previous headings is focussed toward the financial aspects of the project. This side of the investigation normally falls into two parts: that concerned with the amount of money required to bring the project into operation and with the sources from which this money is to be obtained, and that concerned with the operating costs and revenue and the prospective liquidity in the operating phase. In order to explain this approach fully, the main outline

of the following paragraphs assumes a project which is to be carried out by an organization already engaged in operations, and earning revenue.

Taking first the construction period, the first question is: How much money will be needed? The total financial requirements will include some or all of the following items:

(a) The cost of goods and services required for the project, including engineering expenses;

(b) Allowances for escalation and contingencies;

(c) The cost of other capital investments to be made during the same period;

(d) Interest during construction;

(e) Repayment of existing debt during the construction period;

(f) Working capital.

Many projects get into difficulty because inadequate working capital has been provided. The estimation of working capital requirements has to be based on reasonable assumptions concerning the amount of stocks, raw materials, spare parts, goods in process, finished inventories, etc.; the terms on which raw materials are purchased and products are sold, which will indicate the amount of receivables to be financed; and the amount of funds necessary to take care of swings in payments and receipts, taking into account any seasonal variations in production or sales.

The sources from which it is planned to meet the financial requirements will normally include funds (depreciation and undistributed earnings) generated from operations. They may also include the proceeds of the sale

of share capital, and part of the funds will normally be provided by borrowing at long-term, short-term, or both.

The next step in the financial analysis is to prepare projections of three kinds:

(a) An earnings estimate during the construction period to determine the amount of self-generated funds which can be applied to the project;

(b) A cash flow estimate (a statement of estimated receipts and expenditures, from which it can be seen whether funds will be available at the right time to meet the expected requirement); and

(c) Balance sheets which show the financial situation of the organization.

These projections then have to be carried on into the operating period to show the likely financial results of the operation. In these forecasts account must be taken of the time required to overcome initial operating difficulties and the rate at which the market may be able to absorb production. Corresponding calculations will have to be made of the growth in the amount of working capital required.

With these forecasts in hand, the investigators have to form various judgments. They must be satisfied that there will be no shortage of funds during the construction period, and that the financial situation at the end of the period will meet the requirements of sound financial principles. A judgment has to be made whether the expected revenue during the operating period represents a reasonable return on the capital invested, whether there is an adequate margin in the funds generated by operations

to meet fixed financial obligations, and in many cases whether revenue will be adequate to establish reserves needed for sound operation and, in particular, reserves for further expansion.

In light of these judgments the investigators should be able to say whether the proposed financing plan is sound, or whether some change is necessary. They should, in addition, be able to formulate the conditions on which money should be made available for the project. The object of these conditions will, among other things, be to ensure that subsequent action on the part of the management will not jeopardize the soundness of the financial situation and prospects. This may involve placing limitations on freedom to incur future debt, to distribute cash dividends, etc. It may also be necessary to make arrangements for security, and for the provision of additional funds in case they are needed.

CONCLUSION

From the foregoing, it may appear that a Bank appraisal is a formidable ordeal. However, we do not feel that we are being unduly severe in our appraisal -- certainly no more severe than good management should be in examining its own project. We are interested in providing financial assistance for sound projects, but we are not interested in providing finance beyond that necessary to accomplish the sound aims of a project.

Most developing countries need so many things to assist development -- roads, schools, power, housing, etc. -- that usually their legitimate needs are in excess of their financial means. By careful project planning and project control, it is often possible to save considerable money on specific projects which will then release funds for other essential investment needs.

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MEASURING THE BENEFITS OF AN AGRICULTURAL FEEDER-ROAD PROJECT

A Hypothetical Illustration

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Measuring the Benefits of an Agricultural Feeder-Road Project

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This paper illustrates in simplified form the general principles involved in measuring the economic benefits produced by road projects. No attention is paid to the project's costs or to its possible rate of return. The example used is hypothetical: it is not based on any actual project, the initial values used have been assumed. But the values used reflect the normal working of economic forces - e.g., the behaviour of consumer demand in response to lower prices and higher incomes, the effect of cost reductions in extending the area of supply, the effect of competition in spreading economic benefits among different groups, the effect of changed profit margins on production incentives, the shifts in resource use brought about by changes in demand and supply conditions, etc.

The case represents a very common type of road project: a poor-quality, unimproved road leading from an agricultural region to a city is made into a much better road. As a result of this improvement, the unit cost (e.g., the cost per ton-kilometer) of transporting agricultural goods to market is reduced significantly.1/ These savings mean that the same amount of work can now be done with a smaller use of resources than before (e.g., fewer trucks, less gasoline and lubricating oil, fewer repairs, less labor-time, less wear-and-tear on tires, longer vehicle life and hence lower depreciation charges, etc.). These savings are benefits for the national economy. The question of how these benefits will be distributed to various groups in society (their incidence) is a separate question. In the Bank's own project analysis it is assumed that "a benefit is a benefit" no matter how it may affect different groups in the economy.

Any project that reduces costs automatically changes relative prices and hence incentives. As a result of such changes, people change their economic behaviour. The present example is typical of the way road projects affect production and consumption: lower transport costs lead to higher realization prices for farmers and lower prices for consumers. Producers have a new incentive to increase production. Consumers are

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1/ In this example no account is taken of the project's effects on the volume of goods hauled from the city back out to the agricultural regions. This traffic is bound to increase for two reasons: (1) lower transport costs mean that goods can be delivered to the villages at lower prices; this will tend to raise demand (price elasticity effect); (2) The increase in farmers' cash incomes gives them more purchasing power (income elasticity effect). The resulting rise in "back-haul" traffic would increase the benefits produced by the project.

stimulated to buy more at the lower prices. When the farmers' higher output is offered in the market this may push down the market price even more. But as prices go lower buyers are willing to take larger and larger quantities. Some of the increased supply will be bought by people who were already consumers at the old, higher price: at lower prices they want to increase their consumption. But some of the increase will also be taken by new consumers who enter the market for the first time. As a result of the process back-and-forth interaction of these forces the economy gets two main benefits, (1) transport savings, and (2) increased production and trade. The task of measurement is to estimate, in advance, how large these benefits will be. Without an estimate of benefits there is nothing to compare with the costs. No estimate is possible of the project's rate of return and there is no way of judging whether this road project is better for the economy than some other road project - or some railroad project, or an agricultural bank, or a port, etc., etc.

The case identifies and measures three types of benefits: (1) savings in transport costs, (2) increased production and trade, and (3) increases in producers' and consumers' surpluses (these two terms are defined later on). No attempt is made to discuss how the values (prices, costs, profits, surpluses, traffic volumes, etc.) might be collected in actual situations. We simply make certain arbitrary assumptions; all the other values then follow automatically.

Which of the three types of benefits is the best one to use? None. There is no "best" in all circumstances. Different emphasis is given to different benefits according to the particular problem the project is designed to solve. For example, if the aim is to build a "penetration" (or "development") road that will lead to increased production, then most time and energy would be given to the measurement of production benefits. On the other hand, if the main problem is to relieve congestion around a city (where transport costs may be rising because of delays, excessive fuel consumption from much stopping and starting, and high accident rates) then the main objective may be to reduce costs to road users. If a particular stretch of road (e.g., mountain road) has high maintenance costs, then road improvement to reduce both maintenance costs and road-user costs may both be important. Where there is a given volume of traffic to be handled regardless of transport costs, the main appraisal problem is to examine alternative engineering standards, see how much each one costs, and then select the one with the lowest total costs that will still handle the required volume of traffic. This might be true, for example, of a country wanting to minimize investment in transport so as to have more resources for investment in other sectors. The same objective (choosing the minimum-cost alternative) would exist for a mining or logging company needing a service road to a port or out to a main highway or railway. Finally, we have the common objective represented by the type of project used in this case - a road improvement designed mainly to reduce the costs of moving goods from one place to another, knowing this will have benefits for both producers and consumers.

These examples are enough to show that no one benefit is best under all circumstances. If a project offers large benefits of the type primarily wanted then it may not matter if it offers few other benefits. On the other hand, a project which offers large road-user savings[1] for suburban traffic might not be as beneficial to the economy in the long run as a different project with lower returns but where the returns took mainly the form of increased production and trade.

The notes that follow are intended to explain the concepts and computations found in the hypothetical case. Readers should move back and forth freely between these notes and the arithmetic example, which begins on page 13.

1/ The term "road-user savings" appears frequently in the appraisal of road projects. This refers, of course, to reductions in costs paid by those who are the direct users of roads, i.e., vehicle owners. Whether or not these savings increase the incomes and profits of commercial carriers is another question: competition usually forces down the level of transport charges, thus forcing carriers to share their savings with other groups (producers, merchants, and consumers). Thus "road-user savings" should be regarded primarily as a convenient measure of cost savings to the economy as a whole and not as a private benefit accruing only to vehicle owners.

Notes on the Arithmetic Example

I-A-B We begin by assuming a market price of $100. At this price consumers would buy 10,000 units. The normal law of demand is that more units will be sold as the price falls. Here the assumption is that 50% more will be sold if the price falls 10%. The calculations assume a gradual reduction in price, each $1 reduction increasing demand by 500 units (the increase comes from both old and new customers). This particular assumption determines the calculation of "consumers' surplus" which is the difference between the price consumers would be willing to pay and the actual price they can buy it for.

I-D The merchants get 10% of the proceeds from retail sales. This covers their costs (including minimum profit) plus any surplus above this level.1/ What remains is available for transport and production. "Realization price at source" is the amount received by farmers.

I-E At "A" a few producers can produce at $50 per unit but most output costs $60. The higher costs at "A" compared with "B" and "C" reflect the higher costs of land and labor near the city. But "B" and "C" must bear higher transport costs. No supply comes from producers whose production costs are greater than what they will receive after paying transport costs.

I-F-1 This shows the total value of final (retail) sales and how this value was distributed among those who helped produce it. Table F-1 might have been written as follows:

Value produced (or gross national product)		Payments to Persons who produced the GNP	
Agricultural output	$1 mn.	Farmers	$550
		Carriers	350
		Merchants	100
			$1,000

The two sides are just two ways of looking at the same thing: the national product and the distribution of an equivalent amount of values as income to the owners of the factors of production.

1/ When we use the term "costs" for merchants or carriers or farmers we do not assume that all merchants, etc., have the same costs. Some will have higher costs than others. Over time, the high-cost producers tend to be forced out of business; the resources are shifted to other uses where their owners hope they can earn a more satisfactory return. But in the short run the level of charges at each stage in the production process (farmers, carriers, merchants) tends to reflect the higher-cost producers - the marginal enterprises who are just on the edge of being unprofitable. These are the enterprises that do not earn any "producers' surplus". Producers whose costs are lower than the marginal costs are those who earn varying amounts of producers' surplus.

I-F-2 The notion of "producer's surplus" (or "factor surplus") is quite different from the ordinary kind of commercial profit that shows up in accounting records. Its meaning is this: assume that each producer (farmer, carrier, merchant) has some minimum income he considers necessary to draw his resources into a particular use. This minimum may refer to a minimum rent on land, or a minimum wage, or minimum truck operating profit, or minimum wages-plus-profit from merchandising activity. This "minimum income" is determined mainly by what a man thinks he can earn if the resources he owns are devoted to other uses. This "minimum income" may be considered the true "cost" of using resources; anything earned above this amount is called a "producers' surplus". The concept thus involves subjective standards about the minimum earnings the owners of the various factors of production are willing to accept. The concept applies to wages, rents, interest, profits - i.e., to all forms of income earned by "producers" (owners of any factor of production). (Where strong competition exists, it tends to drive "producers' surpluses" down to zero). In the present case, it has been assumed that merchants and carriers earn a "producer's surplus" of 5% of their gross revenues. In agriculture, the producers' surplus is derived from the column on production costs found in I-E. For example, the producers at "A" whose costs for 1,000 units were $50 still received $60 for their output - a surplus of $10 over their costs. Similarly, for the 1,000 units produced for $40 at "B", where each unit had a realization price of $50. The total of these producers' surpluses in agriculture is $20,000.

II We now move to the new situation, soon after the road was built. Production has increased because farmers can now earn higher incomes. Why do they earn more? Because transport costs have been reduced by 50% and some of these savings reach the farmer in the form of higher realization prices even though the retail price is lower. The higher level of output is not sold at the old equilibrium price of $100. Larger supplies have gradually brought the retail price down to a new equilibrium of $90. At this price the number of units producers are willing to supply just equals the number that buyers are willing to purchase (this is the meaning of "equilibrium").

In II-A you will see two figures given for "values of retail sales". Which is the best measure of the true value to the economy of the 15,000 units, a measure based on the actual new price of $90 (the current price) or one that has not changed (the original or constant price)? Note that we are not talking about any change in the value of money - no inflation or deflation. We are dealing only with changes in individual prices arising out of changed supply and demand conditions. The use of current values is probably better since the particular economic changes we are interested in would not have occurred if the original prices had remained in effect (there would undoubtedly have been changes, but different ones).

Notice that the reduction in transport costs benefits the more distant producers more than those closer to the market. The realization price at "C" has gone up $16 (40%); at "A" the realization price rose only $6 (10%). As a result, more of the increased output comes from "C" than from either "A" or "B". This is typical of many actual projects: a major effect of transport projects is to extend the area of supply out from the center of consumption.

III This section (consisting of parts A, B & C) analyzes in detail the overall results shown in section II. "A" shows the increase in GNP and the distribution of this added value among the three levels of activity that contributed to it. In each case the values are shown in both current and constant prices. In current prices the increase in GNP is $350,000. The carriers' total charges were actually $72,500 less after the road improvement than before - a net reduction in transport values counted in national product even though the savings in transport charges are counted as an economic benefit. Savings in the use of transport resources have freed an equivalent amount for use in other sectors. The total receipts of farmers rose $387,000. Merchants' receipts rose $35,000. The sum of these (III-A-5) accounts for the $350,000 increase in GNP.

"B" shows the effect of the project on agricultural, transport, and distribution costs. The figures come from sections I and II. The analysis of costs leaves out of account the effect of the project on producers' surpluses (III-C-1); when the latter are combined with the cost increases we account for the total increase in GNP ($350,000).

The cost increases refer to increases in total costs, not unit costs. Normally we expect it to cost more (i.e. to use more resources) to increase production of an item by 50%, especially since we assume no change in production techniques except in the transport sector. In the latter, the road project is a form of technological change that permits carriers to handle a higher volume of traffic at lower total costs - i.e. with a smaller input of resources from the economy.

The change in market prices and costs affect the surpluses of producers in all three branches of activity. As III-C-1-d shows, most of the increase in surpluses occurred in agriculture: farmers' surpluses increased about six times. Distributors' surpluses increased least. Note that the transport sector had a substantial (nearly 60%) increase in surplus even though total revenue of the sector declined: costs fell even more than revenues.

We come now to the point of central interest, the measurement of economic benefits, using the data we now have before us. Three types of benefits are analyzed:

1. Savings in transport costs (section IV)
2. Increases in Production and Trade (GNP) (Section V)
3. Increases in producers' and consumers' surpluses (Section VI)

IV Transport savings: These take three forms:

a. Savings for the national economy
b. Savings for the owners of vehicles (the carriers or "road users")
c. Savings for the users of vehicles (shippers)

The first is not simply the sum of "B" and "C" (the savings to vehicle owners and users) since part of the owners' savings is passed on to shippers (the farmers) in the form of higher realization prices (competition may force them to do this). Do not try to move back and forth among Formulas 1, 2 and 3. Consider each as a separate calculation.

Formula 1: Less money is spent on transport after the project than before, even though 50% more goods are carried.1/ This is because the reduction in road-user costs has forced carriers, through competition, to lower their charges. (Alternatively, we might assume a state transport monopoly whose charges were reduced by administrative order). Since the difference in transport payments reflects both the lower costs on the original 10,000 units plus an increase in work done (transport of the 5,000 new units) the saving in total outlay of $82,750 must be adjusted to eliminate the value of the new work being performed and give us a measure of savings on the original traffic volume. This is done by adding back the cost of transporting the 5,000 new units. (This figure is "added back" because it has been previously taken out of the savings figure, which had been reduced by the cost of transporting the additional traffic).

A final adjustment is made at the end of Formula 1: a 10% indirect tax is deducted (this might be a gasoline tax, or sales taxes, or city toll, or tariff, or license fees - or all of them combined). Why are these indirect taxes deducted while direct taxes are not? There are two reasons. The first is the different way these taxes affect the use of resources, the second is the distorting effect of indirect taxes on the measurement of resource use.

Direct taxes are levied on a person's property or income after the property or income has become his. Indirect taxes are levied on transactions involving particular goods and services. Money

1/ The problem could have been constructed to show an increase in total outlays. The analysis would proceed exactly the same way.

paid for indirect taxes is paid to the government, even though it may be collected by merchants, bankers, etc., who must turn it over to government. Indirect taxes do not get into the stream of payments reaching people as payments for their contribution to production; hence they do not act as direct incentives to use resources one way as against another.1/ But indirect taxes are part of the price buyers must pay and hence exert an indirect influence, through the price system, on how consumers use their incomes. The resulting savings are savings to the economy, without any indication as to whom they benefit.

Indirect taxes can easily distort economic measurements. For example, if the retail value of gasoline sales rises from x to (x plus y) this might reflect nothing more than an increase in government taxes. The actual volume of sales, and the amount of economic resources required to produce this volume, might not have changed at all. To avoid distortions in true economic values arising from this kind of tax change, we eliminate such taxes from our calculations (this is standard practice in national income accounting).

Formula 2: The road project has resulted in lower costs for truck-owners; these savings are the main form of "road-user benefits". The savings may take the form of lower operating costs (e.g., less fuel and lubrication, fewer repairs, lower wage costs per trip; lower insurance charges) plus lower capital costs (e.g., because vehicles may last twice as long, and each vehicle may make 50 per cent more trips per week, then the amount of depreciation charged on each cargo would be reduced for two reasons). The savings in capital costs mean that either the same volume of traffic could now be handled with a smaller investment in trucks and working capital or that the present investment could support a larger volume of traffic. The lower capital costs does not affect only the individual vehicle owners. The whole economy benefits from the reduced requirement for investment in vehicles and spare parts. Thus investment funds are released for use elsewhere in the economy. In most countries heavily dependent upon imported vehicles, parts, and fuels, the lower unit operating and investment requirements would also result in foreign exchange savings.

Paragraph F-2 (i) shows the actual savings on the original volume of traffic. There then follows an estimate of savings on the induced traffic. Why is only 50% of the $92,250 taken into account? This proportion is a convenient and frequently-used rule-of-thumb for measuring the savings realized on the induced traffic. These "savings" on traffic that did not exist previously (i.e., on induced traffic) are similar to the notions of producer's and consumer's surplus. As transport costs fall

1/ If government services were regarded as a "factor of production", just like labor or capital or natural resources, then it would be logical to leave indirect taxes in the calculation provided that the amount of indirect taxes collected from a given sector (e.g., transport) just equalled the value of government services contributed to that sector (e.g., road construction and maintenance costs, costs of policing). In some countries governments try to collect from road users an amount equal to the costs of building and maintaining the roads. But in many countries there is no such close relationship.

each reduction in (marginal) costs generates some increase in the demand for transport services. The lower costs apply not only to each new increment of traffic but to the earlier increments as well. The earlier increments are thus carried at a price lower than people were formerly willing to pay. People using transport thus save what they no longer have to pay. The 50% factor measures (in an arbitrary but reasonable way) the average savings of everyone involved in transporting the induced traffic between the old and the new cost levels.

F-2(i) plus F-2(ii) gives $212,375. After applying a 10% adjustment for indirect taxes we have a measure of total cost savings to vehicle owners. These savings ($191,140) are greater than the savings to the national economy!

Formula 3: The only difference between F-2 and F-3 is the inclusion of indirect taxes and producers' surplus in F-3, since both elements are included in transport charges paid by clients but not in true transport costs incurred by carriers. F-3 calculates the savings in the amounts actually paid for transport by customers. The difference between F-2(i) and F-3(i) is that the latter includes the "producers' surplus" - the special form of "profit" not included in our definition of true economic "cost". The final F-3 calculation shows what it would have cost to transport 5,000 additional units at the original cost as compared with actual costs after the project. Notice that this calculation uses the full savings ($102,500) not only half of them. Why? Because this measure reflects the normal way people think of transport savings, i.e., savings in cash outlays. They are savings as seen by the people who actually pay for transport. But savings to the economy may be quite different.

V. The project has two main classes of benefits, (1) transport savings and (2) an increase in the volume of production and trade. (A third and less measurable class of benefit, the increase in producers' and consumers' surpluses, is treated in section VI). This section deals only with the increase in production and trade measured by the monetary value of output reaching consumers. We use the term Gross National Product (GNP) as our measure of production values associated with the road project. (Strictly speaking, this is a misuse of the term, since GNP refers only to the sum of values produced by all the economic activities in a country and cannot be applied to any sub-part of the system. We might have used some term such as "Gross Production Value of the Project" but we wanted to retain the language of modern national income accounting).

V-1 calculates the increase in the economy's output of goods and services after completion of the project. Since the main purpose of economic activity is to produce things for final consumers we can take the measure of increased sales to consumers as the measure of the increase in Gross National Product. The result is the same whether we make a single measurement of the values registered in sales to final consumers or whether we go back to the first stage of production (the farm) and measure the increased value of farm production and add to it the values for transporting and selling the higher output. V-1 and V-2 show different ways of estimating the change in GNP, with V-2 breaking down the total into the amounts received by people at various stages in the process of production and distribution.

Indirect taxes are again deducted: although paid by purchasers as part of the retail price, this element of value does not get through to those providing the economic services (the "factors of production") involved in production, transport, and merchandising.

All of the increase in GNP always gets distributed to the many people involved in producing it. Much of this additional payment to the factors of production was necessary to draw them into this particular activity. If these resources (factors of production) had previously been unemployed, then their use on this activity (this particular agriculture, this particular transport, this particular merchandising) would involve no loss of output on other activities. But if the increased output from our project required the use of resources that had been employed elsewhere in the economy, then the gross increase in output generated by the project would need to be reduced by the losses in output elsewhere; only the net increase throughout the economy would count as a gain. Through most of our example we ignore this problem: we treat all of the project gain as a gain for the economy. But in V-3 we show how a gross gain attributable to a project can be converted into a net gain for the economy.

V-2 shows that the change in factor payments is not the full extent of the benefits. If the project has reduced certain prices, then people who buy these things (or "services") have more money left over. They can buy more of the same thing, or of other things, or they can save. So we count any lower prices (reflected here in transport savings) as a benefit, adding them to the higher values of production delivered to the market. This yields a second possible measure of the increase in GNP ($422,500). Who gets this benefit? $35,000 goes to those engaged in marketing; $387,500 goes to the farmers (these figures are derived from data used earlier in the problem).

In V-3 a third measure of the project's effect on national income is shown. It is the best of th three different measures shown in section V. Why? Because it takes into account the additional costs of producing the additional GNP. Only the difference between these two values (benefits and costs) is a clear gain for the economy.1/

V-3 begins with the same increase in GNP used before. However, we deduct from the increase in total retail values the increased costs incurred in producing them. These cost increases are found by taking the difference between the production costs listed in II-C-2 and those listed in I-F-2. After deducting these additional costs of $215,500 we arrive at a net increase in GNP of $134,500. This is the same thing as the increase in factor surpluses (compare II-C-2 and I-F-2); the net profitability of the project shows up as higher returns to the factors of

1/ If we had used the term GNP in its proper sense in sections V-1 and V-2 the adjustment made in V-3 would have been taken care of automatically, by showing lower values for GNP than we used. That is, the increase in gross production value of the project would have been offset by reductions in production values elsewhere in the economy, reductions caused by the transfer of resources into activities generated by our road project.

production, their costs being taken as constant. This "net increase in GNP" can be thought of as the same "net increase in GNP" mentioned earlier when we talked about the need to reduce increases in output directly associated with a project by reductions in output which it causes elsewhere in the economy. Why? Because if the extra $350,000 GNP had been made possible by drawing into use resources formerly unemployed, these resources would have cost nothing, in an economic sense. Therefore whatever cost we put on them would reflect the value they could reasonably be assumed to produce if not used on this particular project (if a resource would be unlikely to find other employment, its value would be very low, perhaps zero). By charging this value-in-alternative-use as a cost against the output of a project we automatically measure the losses in production values at other points resulting from shifting resources into this project. /This explanation shows why projects that draw idle resources into activity often create greater benefits to an economy than projects that involve shifting resources from one use to another/.

VI. It is more difficult and arbitrary to measure consumer and producers' surpluses than to measure other benefits. Also, the surpluses earned by the factors of production (producers' or factor surpluses) are included in measurements of GNP. Consumer surpluses are not included in any of the other measurements.1/ But to consumers, the ability to buy something at prices lower than what they would have been willing to pay is a clear gain: the "saving" represents income that can be used for additional purchases or saving. If we counted savings in transport charges as an economic benefit should we not also count "savings in retail charges" (i.e., price reductions)? Yes, we should. But we should avoid counting any benefit twice - and it is likely that part of the consumer surplus is included in the measurement of increased GNP - i.e., that part of consumer surplus that was used to buy larger quantities as the price went lower.

VII. Section VII draws together the results of the earlier calculations. Note first that the three primary measures used (A,B,C) are not all additive. We can add together certain benefits (notably transport savings and whatever part of increased production we think attributable to the road investment alone. These two benefits are combined in VII-D). But the increases in consumer and producer surpluses are partially included in the other measures and cannot be separately identified.

VII-D shows how one might select certain values from A and B and make a reasonable assumption about what proportion of the increase in agricultural production should be credited to the road invest-

1/ In its own project appraisal work the Bank does not attempt to measure consumer surpluses generated by its projects. But the Bank does take this factor into account qualitatively when appraising the contribution projects will make to increases in consumer incomes and purchasing power.

ment. Some of the production increase would normally be the result of additional public and private investment in the agricultural sector directly.

VII-D illustrates only a few of the many results that are possible. For example, the figure used for transport saving is $149,000 per year. But section A shows eight different figures for measuring "transport savings" in current prices alone! The selection of $149,000 reflects a decision to use "road-user benefits" (i.e. savings to vehicle owners) on the original traffic, measuring these in current prices. This is a widely-used measure of transport savings but, as already pointed out, it is not the only one possible. The conclusion is not that any measure is as good as any other. Rather it is that different figures represent different things that are being measured (even though they may be made to sound alike by calling them all "transport savings"); thus one has to decide what one ought to be trying to measure in each case. In the present case one could argue strongly that the figure of $158,000 (from VII-A-1-b) is a logical one to use, on the ground that one ought to be measuring the effects of the road project on savings for the national economy, taking account of the increase in traffic.

As with transport benefits, so too do we have a number of different measures for the increase in production. B-1 and B-2 use measures of production ("GNP") that do not take into account the costs of obtaining the extra GNP. B-3 does take this into account, by deducting these costs. Which is the better measure of the true increase in GNP? If there is considerable unemployment (or underemployment) in the economy (and especially in this particular region) then the extra costs of producing more GNP may not involve much loss of alternative output, since the resources are not being drawn away from other uses (of course, the situation may be very different for different resources: labor may be unemployed while foreign exchange is very scarce). In addition, you must know whether you want to measure the <u>increase in benefits</u> or the <u>rate of return.</u> This exercise has been concerned exclusively with the measurement of benefits, not with rates of return. Obviously project A may have larger benefits than some project B, but this means nothing until one compares relative costs. So the measurement of benefits deals with only half the problem, though the more difficult half.

VII-D-4 is one possible measure of total benefits to the economy, adding together transport savings plus that portion of the extra GNP that may be credited to the road project alone.

* * * * * *

I. Production, trade, and traffic before conversion of seasonal dirt road to all-weather gravel road

A. Actual volume of sales at $100/unit, retail — 10,000 units p.a

B. Potential volume of sales at market price of $90/unit: each $1.00 decrease in price is assumed to enlarge demand by 500 units — 15,000

C. Value of retail sales at $100/unit — $1,000,000

D. Composition of unit value at retail market

Total price	100
Merchant's purchase price of goods delivered to his premises	90
Merchant's mark-up to cover distribution costs and profits (including any producer's surplus)	10

E. Distribution of supply

Source	Distance from market	Transport charges	Realization price at source	Supply from source (units)	Supply from producers with specified production costs a/		
					$60/unit	$50/ unit	$40/ unit
A	100 mi.	$30/unit	$60/unit	6,000	5,000	1,000	-
B	150	40	50	3,000	-	2,000	1,000
C	200	50	40	1,000	-	-	1,000

F. Analysis of GNP, production costs and producer surpluses

1. Value of retail sales	$1,000,000
Merchant's mark-up	100,000
Payments to carriers and farmers	900,000
To carriers	350,000
To farmers	550,000

	Factor payments	Factor costs of production a/	Factor surpluses above costs
2. Marketing	$100,000 p.a.	$95,000 p.a.	$5,000 p.a.
Transport	350,000	332,500	17,500
Agriculture	550,000	530,000	20,000
Total	$1,000,000	$957,500	$42,500

a/ including minimum return on capital necessary to induce production.

II. Production, trade, and traffic after conversion of seasonal dirt road to all-weather gravel road

A. Volume of sales — 15,000 units p.a.
Price at market (including 10% merchant's mark-up) — $90/unit
Previous effective demand at $100 — 10,000
Previous potential demand at $90-$99 — 5,000
Value of retail sales:
at current prices — $1,350,000
at constant (original) prices — $1,500,000

B. Distribution of supply

Source	Distance from market	Transport charges	Realization price at source	Supply from source (units)	Supply from producers with specified production costs a/ $60/unit	$50/unit	$40/unit
A	100 mi.	$15/unit	$66/unit	7,500	6,500	1,000	-
B	150	20	61	4,500	500	3,000	1,000
C	200	25	56	3,000	-	1,500	1,500

a/ Including minimum return on capital necessary to induce production.

C. Analysis of GNP, production costs, and Consumer and Producer surpluses

1. GNP

Value of retail sales (= GNP in current prices)	$1,350,000
Merchant's mark-up	135,000
Payments to carriers and farmers	1,215,000
Carriers	277,500
Farmers	937,500

2. Producers' costs and surpluses

	Factor payments	Factor costs of production a/	Factor surpluses above costs
Marketing	$135,000 p.a.	$128,250 p.a.	$ 6,750 p.a.
Transport	277,500	249,750	27,750 b/
Agriculture	937,500	795,000 c/	142,500
	$1,350,000	$1,173,000	$177,000

a/ Including minimum return on capital necessary to induce production.
b/ Assumed to increase from 5% to 10% of receipts because of heavier pay loads, faster vehicle turn-around, reduced maintenance needs.
c/ Determined by figures in II-B.

3. Consumer surpluses (from I-B)

Consumer surplus from purchase @ $90/unit of 10,000 units in effective demand earlier @ $100	$100,000
Consumer surplus from purchase @ $90/unit of 5,000 units in potential demand earlier @ $90-99	22,500
Total consumer surplus:	$122,500

III. A. Analysis of Increase in GNP

1. Increase in GNP

	$000 p.a. Before road improvement	After road improvement	Increase (or Decrease)
Value of retail sales:			
current prices	1000	1350	350
constant (original) price	1000	1500	500

2. Transport charges

Paid to carrier			
Goods from source: A	180	112.5	(67.5)
B	120	90	(30.0)
C	50	75	25.0
Value at current prices	350	277.5	(72.5)
Value at constant (original) price	350	308.3	(41.7)

3. Farmer's gross receipts

at source: A	360	495	135
B	150	274.5	124.5
C	40	168	128.0
Value at current prices	550	937.5	387.5
Value at constant (original) price	550	1041.7	491.7

4. Merchant's mark-up (10% of value of sales)

Value at current prices	100	135	35
Value at constant (original) price	100	150	50

5. GNP: Summary

	Current prices	$000 p.a. at constant (original) price
Increased gross receipts of farmers	387.5	491.7
Increased distribution income of merchant's	35	50
total above	422.5	541.7
Subtd. decrease in receipts of carriers	72.5	41.7
Increase in GNP	350.0	500.0

III. B. Analysis of increase in production costs

	before road improvement	after road improvement	increase or decrease
1. Agricultural costs			
Farmer with costs of			
$60/unit	300	420	120
$50/unit	150	275	125
$40/unit	80	100	20
Total production costs: current prices	530	795	265
constant original price	530	883	353
2. Transport costs			
95% of carrier receipts before, 90% after road improvements.			
Goods from source: A	171	101.25	(69.75)
B	114	81	(33)
C	47.5	67.5	20
Total production costs: current prices	332.5	249.75	(82.75)
constant original price	332.5	277.5	(55.0)
3. Distribution			
95% of merchant's mark up:			
Current price	95	128.25	33.25
Constant (original) price	95	142.5	47.5

4. Production costs: Summary

	$000 p.a. Current price	Constant (original) price
Increased production costs of agriculture	265	353
Increased production costs of distribution	33.25	47.5
Total above	298.25	400.5
Subtract: Decreased production costs of transport	82.75	55.0
Increase in production costs incident to increase in GNP	215.5	345.5

IIIC. Analysis of increase in producer and consumer surpluses

1. Producer's surpluses	before road improvement	after road improvement	increase or decrease
		$000 p.a.	
a. Agriculture: Revenue from sale	550	937.5	387.5
Production costs	530	795	265
Surplus (contribution to real net income)-current price	20	142.5	122.5
-constant(original) price	30	158.7	138.7
b. Transport: Revenue from transport	350	277.5	(72.5)
Production costs	332.5	249.75	(82.75)
Surplus (contribution to net real income)-current price	17.5	27.75	10.25
-constant (original) price	17.5	30.8	13.3
c. Distributors:			
Revenue from mark-up	100	135	35
Production costs	95	128.75	33.25
Surplus (contribution to net real income)-current prices	5	6.75	1.75
-constant (original) price	5	7.5	2.5

d. Producers' surplus: Summary	$000 p.a. Current price	Constant (original) price
Increase in surplus accruing to farmers	122.5	138.7
Increase in surplus accruing to merchants	1.75	2.5
Increase in surplus accruing to carriers	10.25	13.3
Total increase	134.5	154.5

2. Consumers' surplus incident to increased sales @ $90 (computed as shown below) $122,500

For Purchasers willing and able to pay	Cons.surplus per unit @ $90 price	Units sold	Total cons. surplus
$100	10	10,000	$100,000
99	9	500	4,500
98	8	500	4,000
97	7	500	3,500
96	6	500	3,000
95	5	500	2,500
94	4	500	2,000
93	3	500	1,500
92	2	500	1,000
91	1	500	500
90	0	0	0
		15,000	$122,500

IV. Economic benefits as measurable by transport savings

	current price
Formula 1. (Savings to national economy)	
10,000 units p.a.: transport cost of production before road improvement	$332,500 p.a.
15,000 units p.a.: transport cost of production after road improvement	249,750
Difference	82,750
Add back: transport cost on improved road of 5,000 additional units	92,250
Saving adjusted for traffic increase	175,000
Deduct: tax component	17,500
Net saving	157,500

Formula 2. (Savings to vehicle owners)

Transport cost to haul original volume of 10,000 units p.a.: applying unit costs before road improvement	$332,500 p.a.
: applying unit costs after road improvement	166,250
(i) Saving, original traffic	166,250
Transport cost to haul additional volume of 5,000 units p.a.: applying unit costs before road improvement	184,500
: applying unit costs after road improvement	92,250
Difference	92,250
50% of difference	46,125
(ii) Saving, induced traffic	46,125
(iii) Road-user savings on original plus induced traffic:	
Saving to vehicle owners	$212,375 p.a.
Deduct: tax component	21,235
Saving in terms of economic cost	191,140

Formula 3. (Savings to vehicle clients)

Transport charges for original volume of 10,000 units p.a.: applying unit charges before road improvement	350,000 p.a.
: applying unit charges after road improvement	175,000
(i) Savings on original volume of goods	175,000
Transport charges for additional volume of 5,000 units p.a.: applying unit charges before road improvement	205,000 p.a.
: applying unit charges after road improvement	102,500
(ii) Savings on additional volume of goods	102,500
(iii) Savings on total volume	$277,500 p.a.

V. Economic benefits as measurable by increased production and trade

	---- $000 p.a. ----	
	Current Prices	Constant (original) Prices
1. Value of retail sales after road improvement		
10,000 original units @ $90	900	1,000
5,000 added units @ $90	450	500
Value at market	1,350	1,500
Subtract: sales of original 10,000 units @ $100 before road improvement	1,000	1,000
a) Increase in GNP (before tax allowance)	350	500
Subtract: 10% allowance for taxes	35	50
b) Adjusted increase in GNP	315	450
2. Increase in GNP (before tax allowance)	350	500
Add: decreased payments for transport of increased volume	72.5	41.7
increase in funds available to pay non-transport factors	422.5	541.7
increased payments for marketing	35	50
increased payments for agriculture	387.5	491.7
3. Increase in GNP (before tax allowance)	350	500
Subtract: increase in total costs of production	215.5	345.5
Net increase in GNP	134.5	154.5
Marketing component	1.75	2.5
Transport	10.25	13.3
Agriculture	122.5	138.7

VI. Economic benefits as measurable by consumer and producer surpluses

	Current prices
1. Consumer surplus from sale of 15,000 units @ $90/unit:	
10,000 units in effective demand before road improvement @ $100/unit	$100,000 p.a.
4,500 units in potential demand before road improvement @ $91-99/unit	22,500
500 units in potential demand before road improvement @ $90/unit	0
Total	$122,500

2. Increase in distribution surplus from sale by merchants of 50% more volume at equal (10%) mark-up — 1,750 p.a.

3. Increase in transport surplus from wider profit margins incident to more intensive use of trucks, heavier payloads, reduced maintenance needs.

10% of charges totaling $277,500 for 2,035,000 ton-miles on improved road	27,750
5% of charges totaling $350,000 for 1,250,000 ton-miles on original road	17,500
Increase	$10,250 p.a.

4. Increase in agricultural surplus from sale by farmer of 50% more volume at higher realization prices.

Source A producers	35,000
Source B producers	54,500
Source C producers	33,000
Increase	$122,500 p.a.

	Current Prices	Constant (original) Prices
Increase in producer surpluses	134.5	154.5
Emergent consumer surplus	122.5	133.6 a/
	257.0	288.1

a/ 10,000 units in previous demand	111.1
5,000 units not in previous demand	22.5
	133.6

VII. Summary comparison of economic benefits as computable by various measures

	---- $000 (rounded) p.a. ----	
	Current Prices	Constant (original) Prices
A. Transport Savings		
1. Savings to national economy (excluding tax component)		
a) without allowance for increased traffic volume	75	83
b) with allowance for increased traffic volume	158	176

	Current Prices	Constant (Original) Prices
2. Savings to vehicle owners		
a) original traffic only:		
i. including tax component	166	185
ii. excluding tax component	149	166
b) original plus induced traffic:		
i. including tax component	213	237
ii. excluding tax component	191	213
3. Savings to vehicle clients		
a) original traffic only	175	194
b) original plus induced traffic	278	309
B. Increased production and trade (excluding tax component)		
1. Increase in GNP without allowance for decreased expenditure to transport increased volume of goods	315	450
2. Increase in GNP plus transport savings adjusted for larger traffic volume	473	626
3. Increase in net real income:		
a) before allowance for release of portion of vehicle fleet for transport service on other roads	121	139
b) allowance for vehicle release assumed equal to 25% of transport costs of production before road improvement	56	62
TOTAL	177	201
C. Increased consumer and producer surplus		
1. Release for other expenditures and/or investment of consumer's income previously spent on buying original volume of goods at higher unit prices	100	111
2. Transfer of consumer income (because of lower price) from other goods and services and/or savings	22.5	22.5
3. Generation of merchant, carrier, and farmer profits available for increased investment and/or expenditure	134.5	154.5
TOTAL	257	288

D. Reduction in transport costs plus increased production and trade attributable to transport investment

	Current Prices
1. Transport savings (costs of production) on original traffic: - current prices (net of tax)	$149,000 p.a.
- constant (original) price	166,000

2. Assumed composition of required incremental investment in transport and agricultural facilities

Total	100%	100%	100%
Road construction and vehicle fleet	75	50	25
Agricultural production	25	50	75

	----- $000 p.a. ----	
	Current Price	Constant (Original) Price
3. Increase in GNP	315	450
Attributable to transport investment assumed to be:		
- 25% of total investment	79	112
- 50%	157	225
- 75%	236	337
4. Economic benefits attributable to improved roads		
Assuming: 25% investment ratio	228	278
50%	306	391
75%	385	503

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MEDICION DE LOS BENEFICIOS DE UN PROYECTO DE CAMINOS LOCALES AGRICOLAS

Una ilustración hipotética

por

Arthur Wubnig
Transport Division
Dept. of Technical Operations

George B. Baldwin
Economic Staff

MEDICION DE LOS BENEFICIOS DE UN PROYECTO
DE CAMINOS LOCALES AGRICOLAS

Este trabajo ilustra en forma simplificada los principios generales involucrados en la medición de los beneficios económicos producidos por los proyectos camineros. No se presta atención a los costos del proyecto o a su posible índice de rentabilidad. El ejemplo que se usa es hipotético: no se basa en ningún proyecto real, los valores iniciales usados son supuestos. Pero los valores usados reflejan la operación normal de las fuerzas económicas - por ejemplo, el comportamiento de la demanda de los consumidores en respuesta a los precios más bajos y a los ingresos más altos, el efecto de las reducciones del costo en la ampliación del área de abastecimiento, el efecto de la competencia sobre la difusión de los beneficios económicos entre diferentes grupos, el efecto de las modificaciones de los márgenes de utilidad sobre los incentivos de producción, los cambios producidos en la aplicación de los recursos por las modificaciones en las condiciones de la oferta y la demanda, etc.

El caso representa un tipo muy común de proyecto caminero: un camino de mala calidad, sin mejoramiento, que conduce desde una región agrícola hacia una ciudad, se convierte en uno mucho mejor. Como resultado de este mejoramiento, el costo unitario (por ejemplo, el costo por tonelada-kilómetro) del transporte de mercaderías agrícolas al mercado se reduce en forma significativa.[1/] Estas economías significan

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1/ En este ejemplo no se toma en cuenta los efectos del proyecto sobre el volumen de mercaderías transportadas desde la ciudad hacia las regiones agrícolas. Este tráfico tiene forzosamente que aumentar por dos motivos: 1) los costos de transporte más bajos significan que se puede entregar las mercaderías en las aldeas a precios más bajos; esto tenderá a aumentar la demanda (efecto de elasticidad de precios); 2) El aumento de ingresos en dinero efectivo de los agricultores imparte a éstos mayor poder comprador (efecto de elasticidad de ingresos). El incremento resultante en el tráfico de retorno aumentaría los beneficios producidos por el proyecto.

que la misma cantidad de trabajo se puede hacer ahora con menor aplicación de recursos que antes (por ejemplo, menor número de camiones, menos gasolina y aceite lubricante, menos reparaciones, menos horas-hombre, menos desgaste de los neumáticos, mayor vida útil del vehículo y, por ello, cargos por depreciación más bajos, etc.).
Estos ahorros son beneficios para la economía nacional. El asunto de cómo se distribuirán estos beneficios entre los diversos grupos de la sociedad (su incidencia) es cuestión aparte. En el propio análisis de proyectos del Banco se supone que "un beneficio es un beneficio", sin tener en cuenta la forma en que pueda afectar a los diferentes grupos de la economía.

Cualquier proyecto que reduzca los costos modifica automáticamente los precios relativos y, por ello, los incentivos. Como resultado de tales modificaciones, la gente, a su vez, modifica su comportamiento económico. El ejemplo actual es típico de la forma en que los proyectos camineros afectan a la producción y el consumo: costos de transporte más bajos conducen a mayores ganancias de venta para los agricultores y a precios inferiores para los consumidores. Los productores tienen un nuevo incentivo para aumentar su producción. Los consumidores se sienten estimulados a comprar más a los precios inferiores. Cuando la mayor producción de los agricultores sea ofrecida en el mercado, ello puede hacer bajar los precios de venta aún más. Pero, a medida que los precios bajan los compradores están dispuestos a absorber cantidades cada vez mayores. Parte del mayor suministro será adquirido por gente que ya era consumidora al precio antiguo, más elevado; a precios más bajos ellos quieren aumentar su consumo. Pero, parte del aumento será absorbido también por los nuevos consumidores que ingresan al mercado por primera vez. Como resultado del proceso de interacción mutua de estas fuerzas, la economía obtiene dos beneficios principales, 1) ahorro en transporte y 2) mayor producción e intercambio comercial. La tarea de la medición es calcular anticipadamente cuán grandes serán estos beneficios. Sin

un cálculo de los beneficios no hay base de comparación con los costos. No es posible calcular el índice de rentabilidad del proyecto ni existe manera de estimar si este proyecto caminero es mejor para la economía que algún otro - o algún proyecto ferroviario, un banco agrícola, un puerto, etc., etc.

Este caso identifica y mide tres tipos de beneficios: 1) ahorros en los costos de transporte, 2) mayor producción e intercambio comercial y 3) aumentos en los excedentes del productor y del consumidor (más adelante definimos estos dos términos). No se intenta debatir cómo se podrían compilar los valores (precios, costos, utilidades, excedentes, volúmenes de tráfico, etc.) en situaciones reales. Nos limitamos a hacer ciertas suposiciones arbitrarias; todos los demás valores se deducen entonces automáticamente.

¿Cuál de los tres tipos de beneficio es el mejor? Ninguno. No hay nada que sea "lo mejor" en todas las circunstancias. Se concede diferente importancia a diferentes beneficios según el problema en particular que el proyecto esté destinado a resolver. Por ejemplo, si el objetivo es construir un camino de "penetración" (o de "desarrollo") que conduzca a una mayor producción, entonces habrá que consagrar la mayor parte del tiempo y de las energías a la medición de los beneficios de producción. Por otra parte, si el problema principal es aliviar la congestión en torno a una ciudad (en donde puede que los costos del transporte estén elevándose a causa de las demoras, el consumo excesivo de combustible debido a las muchas detenciones y reanudaciones de la marcha y los altos índices de accidentes), entonces el objetivo principal puede que sea reducir los costos para los usuarios del camino. Si determinado trecho del camino (por ejemplo, un camino de montaña) tiene costos de mantenimiento elevados, entonces puede que sea importante el mejoramiento del camino para reducir tanto los costos de mantenimiento como los costos para el usuario de esta vía. En donde, sin tener en consideración los costos de transporte, es preciso atender un volumen dado de tráfico, el problema principal de evaluación es estudiar normas técnicas

alternativas, determinar el costo de cada una y luego escoger aquella que ofrezca los costos totales mínimos para atender el volumen requerido de tráfico. Esto podría ser el caso por ejemplo, de un país que desease reducir a un mínimo su inversión en transporte para contar con mayores recursos para invertir en otros sectores. El mismo objetivo (escoger la alternativa de costo mínimo) existiría en el caso de una compañía minera o maderera que necesitase una vía de acceso hacia un puerto o hacia una carretera o ferrocarril. Por último, tenemos el objetivo común representado por el tipo de proyecto usado en este caso - un mejoramiento caminero concebido principalmente para reducir los costos de transportar mercaderías de un lugar a otro, sabiendo que ello acarreará beneficios tanto para los productores como para los consumidores.

Estos ejemplos bastan para demostrar que ningún beneficio es el mejor en todos los casos. Si un proyecto ofrece grandes beneficios del tipo que principalmente se necesita, puede entonces carecer de importancia si ofrece pocos beneficios más. Por otra parte, un proyecto que ofrezca grandes economías a los usuarios del camino[1/] en el caso de tráfico suburbano podría a la larga no ser tan beneficioso para la economía como un proyecto diferente cuya rentabilidad sea inferior pero redunde en mayor producción e intercambio comercial.

1/ El término "ahorro para los usuarios del camino" aparece frecuentemente en la evaluación de proyectos camineros. Esto se refiere, por supuesto, a reducciones en los costos pagados por aquellos que son usuarios directos de los caminos, es decir los dueños de vehículos. Que estos ahorros aumenten o no los ingresos y utilidades de los empresarios de transporte comerciales es asunto aparte: la competencia habitualmente empuja hacia abajo el nivel de los cargos por transporte, obligando así a los empresarios de transportes a compartir su ahorro con otros grupos (productores, comerciantes y consumidores). En esta forma, el término aludido ha de considerarse principalmente como una medida conveniente de las economías de costo para la economía en su conjunto y no como un beneficio privado que perciben solamente los dueños de vehículos.

Las notas que siguen tienen por objeto explicar los conceptos y computaciones que aparecieron en el caso hipotético. Los lectores habrán de pasar libremente de estas notas al ejemplo aritmético, que comienza en la página 6 y viceversa.

Notas sobre el ejemplo aritmético

I-A-B Comenzamos suponiendo un precio de mercado de 100 dólares. A este precio los consumidores comprarían 10 000 unidades. La ley normal de la demanda es que a medida que el precio desciende se venden más unidades. En este caso la suposición es que se venderá un 50 por ciento más si el precio baja en 10 por ciento. Los cálculos suponen una reducción gradual del precio, correspondiendo a cada dólar de rebaja un aumento de la demanda en 500 unidades (el aumento procede tanto de los clientes antiguos como de los nuevos). Esta suposición en particular determina el cálculo del "excedente del consumidor", que es la diferencia entre el precio que los consumidores están dispuestos a pagar y el precio verdadero a que pueden comprar.

I-D Los comerciantes obtienen el 10 por ciento del producto de las ventas al por menor. Esto cubre sus costos (incluso la utilidad mínima) más cualquier excedente por encima de este nivel. 1/ Lo restante queda disponible para el transporte y la producción. El "precio de venta en el lugar de producción" es la cantidad recibida por los agricultores.

1/ Cuando usamos el término "costos" en el caso de comerciantes, empresarios de transportes o agricultores no suponemos que todos los comerciantes, etc., tienen los mismos costos. Algunos tendrán costos más altos que otros. A lo largo del tiempo, los productores de alto costo tienden a ser eliminados de la actividad; los recursos se desplazan a otros usos en donde sus dueños esperan que podrán ganar una utilidad más satisfactoria. Mas, a corto plazo el nivel de los gastos en cada fase del proceso de producción (agricultores, empresarios de transporte, comerciantes) tiende a reflejar a los productores de altos costos - las empresas marginales que están justamente al borde de no ser provechosas. Estas son las empresas que no perciben ningún "excedente del productor". Los productores cuyos costos son inferiores a los costos marginales son aquellos que perciben cantidades variadas de excedente del productor.

I-E En "A" unos pocos productores son capaces de producir a 50 dólares por unidad pero la mayor parte de la producción cuesta 60 dólares. Los mayores costos en "A", comparados con los de "B" y "C", reflejan los mayores costos de la tierra y de la mano de obra cerca de la ciudad. Pero "B" y "C" deben sobrellevar costos de transporte más elevados. No hay oferta de parte de los productores cuyos costos de producción son mayores que lo que ellos recibirán después de pagar los costos de transporte.

I-F-1 Aquí aparecen el valor total de las ventas finales (al por menor) y la forma en que este valor fue distribuido entre aquellos que ayudaron a producirlo. El cuadro F-1 podría haberse escrito en la forma siguiente:

Valor producido (o producto nacional bruto)	Pagos a las personas que produjeron el PNB	
Rendimiento agrícola $1 mn.	Agricultores	$ 550
	Empresarios de transporte	350
	Comerciantes	100
		$ 1 000

Los dos lados son simplemente dos maneras de considerar lo mismo: el producto nacional y la distribución de una cantidad equivalente de los valores como ingreso a los dueños de los factores de producción.

I-F-2 El concepto de "excedente del productor" (o "excedente del factor") es bastante diferente de la clase ordinaria de utilidad comercial que aparece en las anotaciones contables. Su significado es este: supongamos que cada productor (agricultor, empresario de transportes, comerciante) tiene cierto ingreso mínimo que considera necesario para destinar sus recursos a determinado uso. Este mínimo puede que refiera a un arriendo mínimo de la tierra, un salario mínimo, una utilidad mínima sobre la explotación de un camión o un salario mínimo más la utilidad de la actividad comercial. Este "ingreso mínimo" se determina

principalmente por lo que una persona estima que puede ganar si los recursos que posee los dedica a otros usos. Puede considerarse este "ingreso mínimo" como el verdadero "costo" del uso de los recursos; cualquier cosa que se gane por encima de esta cantidad se denomina "excedente del productor". El concepto entraña, de esta manera, normas subjetivas acerca de los ingresos mínimos que los dueños de los diversos factores de producción están dispuestos a aceptar. Este concepto es valedero para los salarios, arriendos, intereses, utilidades, es decir todas las formas de ingreso percibidas por los "productores" (dueños de cualquier factor de producción). (En donde existe fuerte competencia, ésta tiende a hacer descender a cero el "excedente del productor".) En el caso presente, se ha supuesto que los comerciantes y empresarios de transporte obtienen un "excedente del productor" de 5 por ciento de sus ingresos brutos. En la agricultura, el excedente del productor se obtiene de la columna sobre costos de produccción que aparece en I-E. Por ejemplo, los productores de "A", cuyos costos por mil unidades eran 50 dólares siempre recibían 60 dólares por su producción - un excedente de 10 dólares sobre sus costos. El caso es semejante para las 1 000 unidades producidas a un costo de $40 en el caso de "B" donde cada unidad tenía un precio de venta de 50 dólares. El total de estos excedentes del productor en la agricultura es de 20 000 dólares.

II Ahora, poco después de que se contruyó el camino, pasamos a una situación nueva. La producción ha aumentado porque los agricultores pueden ahora percibir ingresos mayores. ¿Por qué ganan más? Porque los costos de transporte se han reducido en 50 por ciento y algunas de estas economías llegan hasta el agricultor en forma de mayores entradas ~~precios~~ de venta, aún cuando el precio al por menor sea más bajo. El nivel de producción más alto no se vende al antiguo precio de equilibrio de 100 dólares. La mayor oferta ha hecho descender gradualmente el precio al por menor a un nuevo nivel de equilibrio de 90 dólares. A este precio, el número de unidades que los productores están dispuestos a proporcionar iguala exactamente al número que los compradores están dispuestos a adquirir (este es el significado de "equilibrio").

En II-A veremos dos cifras dadas para los "valores de las ventas al por menor". ¿Cuál es la mejor medida del valor verdadero que tienen para la economía las 15 000 unidades, una medida basada en el precio nuevo real de 90 dólares (el precio presente) o una que no ha variado (el precio original o constante)? Señalamos que no estamos hablando de variación alguna en el valor del dinero - no se trata de inflación ni deflación. Nos estamos ocupando solamente de las variaciones de precios individuales que surgen de condiciones modificadas en la oferta y la demanda. El uso de valores actuales probablemente sea mejor, puesto que las variaciones económicas que nos interesan no habrían ocurrido si los precios originales hubiesen continuado en vigencia (indudablemente habrían habido cambios, pero de diferente índole).

Obsérvese que la reducción en los costos del transporte beneficia más a los productores más alejados del mercado que a los que están más cerca de él. La entrada bruta de venta en "C" ha subido en 16 dólares (40 por ciento); en "A", solamente subió en 6 dólares (10 por ciento). Como resultado de ello, mayor cantidad de la mayor producción proviene de "C" que de "A" o "B". Esto es característico de muchos proyectos reales: uno de los principales efectos de los proyectos de transporte es la extensión del área de abastecimiento hasta una mayor distancia del centro de consumo.

III Esta sección (que consiste de las partes A, B y C) analiza en detalle los resultados generales que aparecen en la Sección II. "A" nos muestra el aumento en el PNB y la distribución de este valor agregado entre las tres categorías de actividad que han contribuido a él. En cada caso los valores aparecen tanto en precios presentes como constantes. En los precios presentes el aumento del PNB es de 350 000 dólares. Los gastos totales de la empresa de transportes fueron realmente inferiores en 72 500 dólares después del mejoramiento del camino - una rebaja neta en los valores del transporte tomada en cuenta en el producto nacional aún cuando el ahorro en gastos de

transporte se considera beneficio económico. Las economías en el uso de los recursos de transporte han liberado una cantidad equivalente para uso en otros sectores. Los ingresos totales de los agricultores aumentaron en 387 000 dólares. Los de los comerciantes en 35 000 dólares. La suma de estas dos cifras (III-A-5) explica el aumento de 350 000 en el PNB.

"B" nos muestra el efecto del proyecto sobre los costos agrícolas, de transporte y de distribución. Las cifras proceden de las secciones I y II. El análisis de los costos no toma en cuenta el efecto del proyecto sobre el excedente del productor (III-C-1); cuando este último se combina con los aumentos de costo tenemos la explicación del aumento total en el PNB (350 000 dólares).

Los aumentos de costo se refieren a los aumentos en los costos totales, no a los costos unitarios. Normalmente contamos con que cueste más (es decir que sea necesario usar más recursos) aumentar la producción de un rubro en 50 por ciento, especialmente porque no suponemos variación en las técnicas de producción excepto en el sector de transporte. En este último, el proyecto caminero es una forma de variación tecnológica que permite a las empresas de transporte atender un volumen mayor de tráfico a costos totales menores - es decir, con un menor insumo de recursos procedentes de la economía.

Las variaciones en los precios y costos del mercado afectan al excedente del productor en las tres ramas de actividad. Como aparece en III-C-1-d, la mayor parte del aumento en los excedentes ocurrió en la agricultura: el excedente del agricultor aumentó alrededor de seis veces. El excedente del distribuidor fue el que aumentó menos. Obsérvese que el sector del transporte tuvo un aumento substancial (casi 60 por ciento) en el excedente aún cuando el ingreso total del sector declinó: los costos descendieron aún más que los ingresos brutos.

Ahora llegamos al punto de interés central, la medición de los beneficios económicos, haciendo uso de los datos que ahora tenemos ante nosotros. Se analizan tres tipos de beneficios:

1. Ahorro en los costos de transporte (sección IV)
2. Aumentos en la Producción e Intercambio Comercial (PNB)(Sección V)
3. Aumentos en el excedente tanto del productor como del consumidor (Sección VI)

IV <u>Economías en el transporte:</u> Asumen tres formas:

a) Ahorro para la economía nacional
b) Ahorro para los dueños de vehículos (los empresarios de transportes o "usuarios del camino")
c) Ahorro para los usuarios de los vehículos (embarcadores).

Lo primero no es sencillamente la suma de "b" y "c" (el ahorro para los dueños y los usuarios de los vehículos), puesto que parte de las economías para los dueños se traspasan a los embarcadores (los agricultores) en forma de precios de realización más altos (puede que la competencia permita que los agricultores hagan esto). No tratemos de pasar de una a otra entre las fórmulas 1, 2 y 3. Consideremos a cada una como un cálculo aparte.

<u>Fórmula 1</u>: Se gasta menos dinero en transporte después de ejecutado el proyecto que antes, aunque se transporte un 50 por ciento más de mercaderías.[1/] Esto se debe a que la reducción en los costos del usuario del camino ha obligado a las empresas de transporte, por medio de la competencia, a rebajar sus cobros. (Alternativamente, podríamos suponer un monopolio estatal de los transportes cuyos cobros se redujesen por una orden administrativa). Como la diferencia en los pagos por transporte refleja tanto los <u>costos inferiores</u> sobre las primitivas 10 000 unidades más un <u>aumento en la labor realizada</u> (transporte de 5 000 unidades más), la diferencia de 82 750 dólares a favor en el desembolso total debe ajustarse en forma de eliminar el valor de la nueva labor en ejecución y darnos una medida de las economías con respecto al volumen de tráfico primitivo. Esto se hace agregando de

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1/ Se pudo haber planteado el problema en forma de que apareciese un <u>aumento</u> en los gastos totales. El análisis se desarrollaría exactamente en la misma forma.

nuevo el costo de transporte de las 5 000 unidades adicionales. (Esta cifra se "agrega de nuevo" porque había sido anteriormente restada a la cifra de las economías, que el costo de transportar el tráfico adicional había reducido.)

Al final de la Fórmula 1 se hace un ajuste final: se deduce un impuesto indirecto de 10 por ciento (podría ser éste un impuesto sobre la gasolina o las ventas, un peaje municipal, un derecho aduanero o derechos de emisión de licencia - o todo junto). ¿Por qué se deducen estos impuestos indirectos y no los directos? Hay dos motivos. El primero es la forma diferente en que estos impuestos afectan el uso de los recursos, y el segundo es el efecto perturbador de los impuestos indirectos sobre la medición del uso de los recursos.

Los impuestos directos se establecen sobre los bienes o ingresos de una persona una vez que dichos bienes o ingresos han pasado a ser suyos. Los impuestos indirectos se establecen sobre las transacciones relacionadas con determinados bienes y servicios. El dinero pagado por impuestos indirectos se paga al gobierno, aún cuando sea recaudado por los comerciantes, banqueros, etc., quienes deben a su vez entregarlo al gobierno. Los impuestos indirectos no entran en la corriente de los pagos que recibe la gente por concepto de retribución a su propia contribución a la producción; por ello no actúan como incentivos directos para usar los recursos en un sentido en lugar de otro.[1/] Pero, los impuestos indirectos forman parte del precio que los compradores han de pagar y, por ello, ejercen una influencia directa, mediante el

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1/ Si los servicios gubernativos se consideran "factor de producción", tal como la mano de obra, el capital o los recursos naturales, sería entonces lógico dejar los impuestos indirectos en los cálculos siempre que la cantidad recaudada de dichos impuestos en determinado sector (por ejemplo, el transporte) fuese exactamente igual al valor de los servicios gubernativos aportados a dicho sector (por ejemplo, los costos de construcción y conservación de los caminos, los costos de vigilancia policial). En algunos países, los gobiernos tratan de recaudar de los usuarios de los caminos una cantidad igual a los costos de construcción y mantenimiento de estas vías. Pero, en muchos países no hay una relación tan estrecha.

sistema de precios, sobre la forma en que los consumidores hacen uso de sus ingresos. El ahorro resultante es para la economía, sin indicación alguna acerca de a quién beneficia.

Los impuestos indirectos pueden fácilmente perturbar las mediciones económicas. Por ejemplo, si el valor al por menor de las ventas de gasolina se eleva de x a (x más y), esto podría reflejar simplemente un aumento en los impuestos del gobierno. El volumen real de ventas y la cantidad de recursos económicos necesarios para producirlo podrían no haber variado en absoluto. Para evitar deformaciones en los valores económicos verdaderos provenientes de esta clase de modificación tributaria, eliminamos tales impuestos de nuestros cálculos (este es el método normal en la contabilidad del ingreso nacional).

Fórmula 2: El proyecto caminero se ha traducido en costos inferiores para los dueños de camiones; estas economías constituyen la principal forma que asumen los "beneficios para el usuario del camino". Las economías pueden asumir la forma de costos de explotación más bajos (por ejemplo, menos combustible y lubricación, menor número de reparaciones, menores costos de salarios por viaje; primas de seguro más bajas) más costos de capital más bajos (por ejemplo, puede que los vehículos duren el doble y cada uno haga un 50 por ciento más de viajes por semana, con lo cual la cantidad de depreciación cargada a cada cargamento se reduciría por dos motivos). El ahorro en costos de capital significa que ahora se puede atender el mismo volumen de tráfico con una menor inversión en camiones y capital de explotación o bien que la inversión actual podría atender un mayor volumen de tráfico. Los costos de capital más bajos no afectan solamente a los dueños de vehículos individualmente considerados. La economía en su conjunto se beneficia con la menor necesidad de invertir en vehículos y repuestos. En esta forma, el dinero para inversiones queda en libertad para ser invertido en otros sectores de la economía. En la mayor parte de los países que dependen en alto grado de la importación para proveerse de vehículos, repuestos y combustibles, los menores requisitos de explotación e inversión por unidad también se traducirían en ahorro de divisas extranjeras.

En el Párrafo F-2 (i) aparece el ahorro real con respecto al volumen original de tráfico. Luego aparece un cálculo del ahorro con respecto al tráfico inducido. ¿Por qué se toma en cuenta solamente 50 por ciento de los 92 250 dólares? Esta proporción es un método empírico conveniente y de frecuente uso para medir el ahorro obtenido con respecto al tráfico inducido. Este "ahorro" con respecto al tráfico que antes no existía (es decir tráfico inducido) se asemeja a los conceptos de excedente del productor y excedente del consumidor. A medida que los costos bajan, cada reducción en los costos (marginales) da origen a algún aumento en la demanda de servicios de transporte. Los costos inferiores son aplicables no solamente a cada nuevo aumento de tráfico sino a los aumentos anteriores también. Los incrementos anteriores se transportan así a un precio inferior al que la gente estaba anteriormente dispuesta a pagar. La gente que usa los transportes ahorra así aquello que ya no tiene que seguir pagando. El factor del 50 por ciento mide (en forma arbitraria pero razonable) el promedio de ahorro de todos aquellos relacionados con el transporte del tráfico inducido entre los niveles antiguos y nuevos de costos.

F-2(i) más F-2(ii) da 212.375 dólares. Después de aplicar un ajuste de 10 por ciento por impuestos indirectos tenemos una medida del ahorro total de costo para los dueños de vehículos. Este ahorro (191.140 dólares) es mayor que el ahorro para la economía nacional.

Fórmula 3: La única diferencia entre F-2 y F-3 es la inclusión de los impuestos indirectos y el excedente del productor en F-3, ya que ambos elementos están incluidos en los gastos de transporte pagados por los clientes pero no en costos de transporte verdaderos en que hayan incurrido las empresas de transportes. F-3 calcula el ahorro en las cantidades que, por el transporte, pagan realmente los clientes. La diferencia entre F-2(i) y F-3(i) está en que este último comprende el "excedente del productor" - la forma especial de "utilidad" no comprendida en nuestra definición del verdadero "costo" económico.

En el cálculo final de F-3 aparece lo que costaría transportar 5 000 unidades adicionales al costo primitivo en comparación con los costos reales después de ejecutado el proyecto. Obsérvese que este cálculo aplica el ahorro total (102 500 dólares) y no solamente la mitad de él. ¿Por qué? Porque esta medida refleja la opinión normal de la gente sobre el ahorro en transportes, es decir ahorro en gastos en dinero efectivo. Es ahorro en la forma en que lo contempla la gente que realmente paga por el transporte. Pero, el ahorro para la economía puede ser muy diferente.

V El proyecto tiene dos clases principales de beneficios, 1) economía en transportes y 2) aumento en el volumen de producción e intercambio comercial. (Una tercera y menos mensurable clase de beneficio, el aumento en el excedente tanto del productor como del consumidor, está tratada en la Sección VI). Esta sección se ocupa solamente del aumento en la producción e intercambio comercial medido por el valor monetario de la producción que llega al consumidor. Usamos el término Producto Nacional Bruto (PNB) como nuestra medida de los valores de producción asociados con el proyecto caminero. (Rigurosamente hablando, es un mal uso del término puesto que el PNB se refiere solamente a la suma de los valores producidos por todas las actividades económicas de un país y no puede aplicarse a ninguna subdivisión del sistema. Podríamos haber usado algún otro término como "Valor Bruto de Producción del Proyecto" pero deseábamos atenernos al idioma de la contabilidad moderna de ingresos nacionales).

V-1 calcula el aumento en el rendimiento de bienes y servicios de la economía uha vez terminada la ejecución del proyecto. Como la finalidad principal de la actividad económica es producir objetos para los consumidores finales, podemos considerar la medida del aumento en las ventas a los consumidores como la medida del aumento en el Producto Nacional Bruto. El resultado es el mismo, sea que hagamos una sola medición de los valores registrados en las ventas a los consumidores

finales o que nos retrotraigamos a la primera fase de la producción (la finca) y midamos el mayor valor de la producción agrícola para añadirlo a los valores correspondientes al transporte y venta de la mayor producción. En V-1 y V-2 aparecen diferentes maneras de calcular la variación en el PNB, descomponiéndose en V-2 el total en las cantidades recibidas por la gente en las diversas fases del proceso de la producción y distribución.

Nuevamente se deducen los impuestos indirectos: aunque haya sido pagado por los compradores como parte del precio al por menor, este elemento del valor no llega hasta aquellos que proporcionan los servicios económicos (los "factores de producción") que participan en la producción, transporte y venta.

El total del aumento en el PNB siempre se reparte entre las muchas personas que se ocupan de producirlo. Gran parte de este pago adicional a los factores de producción era necesaria para inducirlos a esta actividad en particular. Si estos recursos (factores de producción) hubiesen sido empleados con anterioridad, entonces su uso en esta actividad (tal agricultura en particular, tal transporte en particular, tal venta en particular) no involucraría pérdida de producción en otras actividades. Pero, si la mayor producción proveniente de nuestro proyecto requiriese el uso de recursos que hubieran sido empleados en otros sectores de la economía, entonces el aumento bruto de la producción originado por el proyecto sería necesario reducirlo en la medida de las pérdidas sufridas por la producción en otros sectores; solamente el aumento neto en toda la economía sería considerado ganancia. A través de la mayor parte de nuestro ejemplo nos hemos abstenido de contemplar este problema: tratamos el total del beneficio del proyecto como beneficio para la economía. Pero, en V-3 demostramos en qué forma se puede convertir una ganancia bruta atribuible a un proyecto en una ganancia neta para la economía.

V-2 demuestra que la variación en los pagos a los factores no es el total de los beneficios. Si el proyecto ha reducido ciertos precios, entonces la gente que compra estos objetos (o "servicios") tiene más dinero sobrante. Puede comprar mayor cantidad del mismo objeto, o de otros objetos, o puede ahorrar. Es así como tomamos en consideración como beneficio cualesquiera precios inferiores (reflejados aquí en ahorro en transporte), agregándolos a los mayores valores de la producción entregada al mercado. Esto proporciona una segunda medida posible del aumento en el PNB (422,500 dólares). ¿Quién recibe el beneficio? Treinticinco mil dólares van a aquellos que se ocupan de la venta; 387 500 dólares van a los agricultores (estas cifras se obtuvieron de los datos usados anteriormente en el problema).

En V-3 aparece una tercera medida de los efectos del proyecto sobre el ingreso nacional. Es la mejor de las tres mediciones diferentes que aparecen en la Sección V. ¿Por qué? Porque toma en cuenta los costos adicionales de producir el PNB adicional. Solamente la diferencia entre estos dos valores (beneficios y costos) es una ganancia evidente para la economía.1/

V-3 comienza con el mismo aumento de PNB usado anteriormente. Sin embargo, rebajamos del aumento en los valores totales al por menor los mayores costos causados para producirlos. Estos aumentos de costo se determinan considerando la diferencia entre los costos de producción enumerados en II-C-2 y aquellos enumerados en I-F-2. Rebajados estos costos adicionales de la cantidad de 215 000 dólares, llegamos a un aumento <u>neto</u> del PNB de 134 500 dólares. Esto es lo mismo que el

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1/ Si hubiésemos usado el término PNB en su sentido correcto en las secciones V-1 y V-2, el ajuste hecho en V-3 habría sido atendido automáticamente, dando valores inferiores a los usados por nosotros para el PNB. Es decir, el aumento en el valor de la producción bruta del proyecto habría quedado compensado por reducciones en los valores de la producción en otros sectores de la economía, reducciones causadas por la transferencia de recursos hacia actividades originadas por nuestro proyecto caminero.

aumento en los excedentes de los factores (compárese II-C-2 e I-F-2); la productividad neta del proyecto aparece en forma de altas utilidades para los factores de producción, tomándose los costos de estos últimos como constantes. Este "aumento neto del PNB" puede considerarse como el mismo "aumento neto del PNB" mencionado anteriormente cuando hablábamos de la necesidad de reducir los aumentos de producción directamente relacionados con un proyecto mediante reducciones en la producción que origina en otros sectores de la economía. ¿Por qué? Porque si el PNB adicional de 350 000 dólares se hubiese posibilitado haciendo uso de recursos que anteriormente no se habían utilizado, dichos recursos no habrían costado nada, en un sentido económico. Por consiguiente, cualquier costo que les atribuyamos reflejaría el valor que podría suponerse razonablemente que producirían si no se usaran en este proyecto en particular (si fuera improbable que un recurso encontrara otra aplicación, su valor sería bajísimo, acaso nulo). Cargando este valor de la aplicación alternativa como costo contra la producción de un proyecto, medimos automáticamente las pérdidas en valores de producción que en otros sectores resultarían del desplazamiento de recursos hacia este proyecto. (Esta explicación demuestra por qué los proyectos que incorporan a la actividad recursos inactivos crean a menudo mayores beneficios para la economía que aquellos que entrañan desplazamiento de recursos de una aplicación a otra).

VI Es más difícil y arbitrario medir los excedentes del consumidor y del productor que medir otros beneficios. Asimismo, los excedentes percibidos por los factores de producción (excedentes del productor o del factor) están comprendidos en la medición del PNB. Los excedentes del consumidor no están comprendidos en ninguna de las otras mediciones.[1/]

1/ En su propio trabajo de evaluación de proyectos, el Banco no pretende medir los excedentes del consumidor originados por sus proyectos. Pero, el Banco sí toma en cuenta cualitativamente este factor al evaluar el aporte que los proyectos harán a los aumentos en los ingresos y poder adquisitivo del consumidor.

Pero, para los consumidores esta capacidad de comprar algo a precios inferiores a los que habrían estado dispuestos a pagar es una ganancia evidente: la "economía" representa un ingreso que se puede aplicar a compras suplementarias o al ahorro. ¿Si hemos tomado en cuenta el ahorro en gastos de transporte como un beneficio económico, no habremos también de tomar en cuenta "el ahorro en gastos al por menor" (es decir, rebajas de precio)? Sí, por cierto. Pero hemos de evitar tomar en cuenta dos veces los beneficios - y es probable que parte del excedente del consumidor esté comprendido en la medición del PNB aumentado - es decir, aquella parte del excedente del consumidor que se aplicó a la compra de mayores cantidades a medida que el precio descendía.

VII La Sección VII reune los resultados de los cálculos anteriores. Obsérvese primero que las tres medidas primarias aplicadas (A, B, y C) no son todas aditivas. Podemos sumar entre sí ciertos beneficios (señaladamente el ahorro en el transporte y cualquiera porción de la mayor producción que estimemos atribuible solamente a la inversión caminera. Estos dos beneficios aparecen combinados en VII-D). Pero, los aumentos en los excedentes del consumidor y del productor están comprendidos parcialmente en las demás mediciones y no pueden ser identificados por separado.

VII-D nos muestra cómo podríamos escoger ciertos valores de A y B y hacer un supuesto razonable acerca de qué proporción del aumento de la producción agrícola se ha de reconocer a la inversión caminera. Parte del aumento de producción sería normalmente el resultado de inversiones adicionales tanto públicas como privadas hechas en forma directa en el sector agrícola.

VII-D ilustra solamente algunos de los muchos resultados posibles. Por ejemplo, la cifra aplicada al ahorro en el transporte es 149.000 dólares al año. Pero en la Sección A aparecen ocho cifras diferentes para medir el "ahorro en transportes" en precios presentes solamente.

El hecho de que se haya escogido la cantidad de 149 000 dólares refleja una resolución de aplicar los "beneficios para el usuario del camino" (es decir el ahorro para los dueños de vehículos) provenientes del tráfico original, midiéndolos en precios presentes. Es una difundida medición del ahorro en transportes pero, como ya se señaló, no es la única posible. La conclusión no es que cualquier medida sea tan buena como otra. Más bien, es que cifras diferentes representan cosas diferentes que se están midiendo (aunque se las haga parecer iguales denominándolas a todas "ahorro en transportes"); así es necesario determinar lo que se debería procurar medir en cada caso. En el caso presente podríamos sostener firmemente que la cifra de 158 000 dólares (de VII-A-1-b) es lógicamente aplicable, por el motivo de que deberíamos medir los efectos del proyecto caminero sobre el ahorro para la economía nacional, tomando en cuenta el aumento en el tráfico.

Como en el caso de los beneficios del transporte, también tenemos numerosas medidas diferentes para el aumento de producción. B-1 y B-2 aplican medidas de producción ("PNB") que no toman en cuenta los costos de obtención del PNB adicional. B-3 no toma en cuenta esto, mediante la deducción de los costos. ¿Cuál es la mejor medida del verdadero aumento del PNB? Si existe considerable desempleo (o subempleo) en la economía (y especialmente en esta región en particular) entonces los costos suplementarios de producir más PNB puede que no entrañen mucha pérdida de producción alternativa, ya que no se están restando recursos a otros usos (por supuesto, puede que la situación sea muy diferente tratándose de diferentes recursos: puede que la mano de obra esté desocupada en circunstancias de que las divisas extranjeras estén muy escasas). Además, debemos saber si queremos medir el <u>aumento en los beneficios</u> o el <u>índice de rentabilidad</u>. Este ejercicio se ha ocupado exclusivamente de la medición de los beneficios, no los índices de rentabilidad. Evidentemente el proyecto A

puede que tenga mayores beneficios que un proyecto B, pero esto no significa nada hasta tanto no comparemos los costos relativos. Es así como la medición de los beneficios se ocupa solamente de la mitad del problema, si bien la mitad más difícil.

VII-D-4 es una posible medida de los beneficios totales para la economía, que suma en conjunto el ahorro en transportes más aquella porción del PNB suplementario que se puede reconocer al proyecto caminero solamente.

I. Producción, comercio y tráfico antes de la transformación del camino de temporada en camino de grava para todo tiempo

A. Volumen real de ventas a 100 dólares por unidad, al por menor — 10 000 unidades p.a.

B. Volumen potencial de ventas al precio de mercado de 90 dólares por unidad: cada dólar de descenso en el precio se supone que aumenta la demanda en 500 unidades — 15 000

C. Valor de las ventas al por menor a 100 dólares por unidad — $1 000 000

D. Composición del valor unitario en el mercado al por menor

Precio total	100
Precio de compra al comerciante de las mercaderías entregadas en su establecimiento	90
Recargo del comerciante para cubrir los costos de distribución y las utilidades (comprendido cualquier excedente del productor)	10

E. Distribución del suministro

Lugar de producción	Distancia del Mercado	Cobros por transporte	Precio de venta en el lugar de producción	Suministro desde el lugar de producción (unidades)	Suministro proveniente de los productores con costos especificados de producción[a]		
					$60/ unidad	$50/ unidad	$40/ unidad
A	100 millas	$30/unidad	$60/unidad	6 000	5 000	1 000	-
B	150	40	50	3 000	-	2 000	1 000
C	200	50	40	1 000	-	-	1 000

F. Análisis del PNB, costos de producción y excedentes del productor

1. Valor de las ventas al por menor	$1 000 000
Recargo del comerciante	100 000
Pagos a los empresarios de transporte y a los agricultores	900 000
A los empresarios de transporte	350 000
A los agricultores	550 000

	Pagos a los factores	Costos de los factores de producción[a]	Excedentes de los factores por encima de los costos
2. Venta	$100 000 p.a.	$95 000 p.a.	$5 000 p.a.
Transporte	350 000	332 500	17 500
Agricultura	550 000	530 000	20 000
Total	$1 000 000	$957 500	$42 500

a/ Comprendida la rentabilidad mínima sobre el capital que es necesaria para inducir producción.

II. Producción, comercio y tráfico después de la transformación del camino de temporada en camino de grava para todo tiempo.

A. Volumen de ventas — 15 000 unidades p.a.

Precio en el mercado (comprendido el 10 por ciento de recargo del comerciante)	$90/unidad
Demanda efectiva anterior a 100 dólares	10 000
Demanda potencial anterior a 90-99 dólares	5 000
Valor de las ventas al por menor:	
a los precios presentes	$1 350 000
a los precios constantes (primitivos)	$1 500 000

B. Distribución del suministro

Lugar de producción	Distancia del Mercado	Cobros por	Precio de venta en el lugar de producción	Suministro desde el lugar de producción (unidades)	Suministro proveniente de los productores con costos especificados de producción a/		
					$60/ unidad	$50/ unid.	$40/ unid.
A	100 millas	$15/unidad	$66/unidad	7 500	6 500	1 000	-
B	150	20	61	4 500	500	3 000	1 000
C	200	25	56	3 000	-	1 500	1 500

a/ Comprendida la rentabilidad mínima sobre el capital que es necesaria para inducir producción.

C. Análisis del PNB, costos de producción y excedentes del productor

1. PNB

Valor de las ventas al por menor (PNB en precios corrientes)	$1 350 000
Recargo del comerciante	135 000
Pago a los empresarios de transporte y a los agricultores	1 215 000
A los empresarios de transporte	277 500
A los agricultores	937 500

2. Costos y excedentes del productor

	Pagos a los factores	Costos de los factores de producción a/	Excedentes de los factores por encima de los costos
Venta	$135 000 p.a.	$128 250 p.a.	$ 6 750 p.a.
Transporte	277 500	249 750	27 750 b/
Agricultura	937 500	795 000 c/	142 500
	$1 350 000	$1173 000	$177 000

a/ Comprendida la rentabilidad mínima sobre el capital que es necesaria para inducir producción.

b/ En el supuesto de que experimente un aumento de 5 a 10 por ciento en sus ingresos a causa del transporte de carga útil de mayor peso, una rotación más rápida de los vehículos y una reducción en las necesidades de conservación.

c/ Determinado según las cifras que aparecen en II-B.

3. <u>Excedentes del consumidor</u> (según I-B)

Excedente del consumidor procedentes de la adquisición a 90 dólares la unidad de 10 000 unidades que anteriormente estaban en demanda efectiva a 100 dólares la unidad.	$100 000
Excedente del consumidor procedente de la adquisición a 90 dólares la unidad de 5 000 unidades que anteriormente estaban en demanda potencial a 90-99 dólares la unidad	22 500
Total de excedentes del consumidor:	$122 500

III. A. Análisis del aumento en el PNB

1. Aumento en el PNB

	en miles de dólares anuales		
	Antes del mejoramiento del camino	Después del mejoramiento del camino	Aumento (o Disminución
Valor de las ventas al por menor			
a precios presentes	1000	1350	350
al precio constante (primitivo)	1000	1500	500
2. Gastos de transporte			
Pagado a la empresa de transportes			
Mercaderías procedentes del lugar de producción: A	180	112.5	(67.5)
B	120	90	(30.0)
C	50	75	25.0
Valor a precios presentes	350	277.5	(72.5)
Valor al precio constante (Primitivo)	350	308.3	(41.7)
3. Ingresos brutos del agricultor			
En el lugar de producción: A	360	495	135
B	150	274.5	124.5
C	40	168	128.0
Valor a precios ordinarios	550	937.5	387.5
Valor al precio constante (primitivo)	550	1041.7	491.7
4. Recargo del comerciante (10 por ciento del valor de las ventas)			
Valor a precios ordinarios	100	135	35
Valor al precio constante (primitivo)	100	150	50

5. PNB: Resumen

	En miles de dólares anuales	
	Precios corrientes	Precios constantes (primitivos)
Mayores ingresos brutos de los agricultores	387.5	491.7
Mayor ingreso de los comerciantes por concepto de distribución	35	50
Total	422.5	541.7
Rebaja de la disminución en los ingresos de las empresas de transporte	72.5	41.7
Aumento en el PNB	350.0	500.0

III. B. Análisis del aumento en los costos de producción

	Antes del mejoramiento del camino	Después del mejoramiento del camino	Aumento o Disminución
1. Costos agrícolas			
Agricultor con costos de			
60 dólares la unidad	300	420	120
50 dólares la unidad	150	275	125
40 dólares la unidad	80	100	20
Costos totales de producción:			
a precios ordinarios	530	795	265
al precio constante (primitivo)	530	883	353
2. Costos de transporte			
95 por ciento de los ingresos de la empresa de transportes antes de las mejoras en el camino, 90 por ciento después de ellas.			
Mercaderías procedentes de la fuente:			
A	171	101.25	(69.75)
B	114	81	(33)
C	47.5	67.5	20
Costos totales de producción			
a precios ordinarios	332.5	249.75	(82.75)
al precio constante (primitivo)	332.5	277.5	(55.0)
3. Distribución			
95 por ciento del recargo del comerciante:			
al precio ordinario	95	128.25	33.25
al precio constante (primitivo)	95	142.5	47.5

4. Costos de producción: Resumen

	en miles de dólares anuales	
	Precios corrientes	Precios constantes (primitivos)
Mayores costos de producción de la agricultura	265	353
Mayores costos de producción de la distribución	33.25	47.5
Total	298.25	400.5
Rebajar: Menores costos de producción del transporte	82.75	55.0
Mayores costos de producción que inciden en un aumento del PNB	215.5	345.5

III. C. Análisis del aumento en los excedentes del productor y del consumidor

1. Excedentes del productor	En miles de dólares anuales: Antes del mejoramiento del camino	Después del mejoramiento del camino	Aumento o Disminución
a. Agricultura: Ingreso proveniente de la venta	550	937.5	387.5
Costos de producción	530	795	265
Excedente (aporte al ingreso neto verdadero) - precio ordinario	20	142.5	122.5
- precio constante (primitivo)	30	158.7	138.7
b. Transporte: Ingreso proveniente del transporte	350	277.5	(72.5)
Costos de producción	332.5	249.75	(82.75)
Excedente (aporte al ingreso neto real) - precio ordinario	17.5	27.75	10.25
- precio constante (primitivo)	17.5	30.8	13.3
c. Distribuidores			
Ingreso proveniente del recargo	100	135	35
Costos de producción	95	128.75	33.25
Excedente (aporte al ingreso neto real) - precios ordinarios	5	6.75	1.75
- precio constante (primitivo)	5	7.5	2.5

d. Excedente del Productor: Resumen	En miles de dólares anuales: Al precio ordinario	Al precio constante (primitivo)
Aumento del excedente que perciben los agricultores	122.5	138.7
Aumento del excedente que perciben los comerciantes	1.75	2.5
Aumento del excedente que perciben los empresarios de transporte	10.25	13.3
Aumento total	134.5	154.5

2. Excedente del consumidor correspondiente a la mayor venta a 90 dólares (computado en la forma expuesta más adelante) $122 500

Para Compradores en condiciones de pagar	Excedente del consumidor por unidad al precio de 90 dólares	Unidades vendidas	Total de excedente del consumidor
$100	10	10 000	$100 000
99	9	500	4 500
98	8	500	4 000
97	7	500	3 500
96	6	500	3 000
95	5	500	2 500
94	4	500	2 000
93	3	500	1 500
92	2	500	1 000
91	1	500	500
90	0	0	0
		15 000	$122 500

V. Beneficios económicos mensurables por el ahorro en transporte

	Precio ordinario
Fórmula 1. (Ahorro para la economía nacional)	
10 000 unidades al año: costo de transporte de la producción antes del mejoramiento del camino	$332 500 p.a.
15 000 unidades al año: costo de transporte de la producción después del mejoramiento del camino	249 750
Diferencia	82 750
Agréguese nuevamente: costo del transporte de 5 000 unidades adicionales por camino mejorado	92 250
Ahorro ajustado de acuerdo con el aumento en el tráfico	175 000
Rebajar: elemento impuesto	17 500
Ahorro neto	157 500
Fórmula 2. (Ahorro para los dueños de vehículos)	
Costo de transporte del volumen primitivo de 10 000 unidades anuales: aplicando costos unitarios anteriores al mejoramiento del camino	$332 500 p.a.
: aplicando costos unitarios posteriore al mejoramiento del camino	166 250
(i) Economía, tráfico primitivo	166 250
Costo de transporte del volumen adicional de 5 000 unidades anuales: aplicando costos unitarios anteriores al mejoramiento del camino	184 500
: aplicando costos unitarios posteriores al mejoramiento del camino	92 250
Diferencia	92 250
50 por ciento de la diferencia	46 125
(ii) Ahorro, tráfico inducido	46 125
(iii) Ahorro del usuario del camino en el tráfico primitivo más el inducido:	
Ahorro para los dueños de vehículos	$212 375 p.a.
Rebajar: componente impuestos	21 235
Economía en términos de costo económico	191 140
Fórmula 3. (Economía para los clientes de los vehículos)	
Gastos de transporte del volumen original de 10 000 unidades anuales: aplicando gastos unitarios anteriores al mejoramiento del camino	350 000 p.a.
: aplicando gastos unitarios posteriores al mejoramiento del camino	175 000
(i) Ahorro en el volumen primitivo de mercaderías	175 000
Gastos de transporte del volumen adicional de 5 000 unidades anuales: aplicando gastos unitarios anteriores al mejoramiento del camino	205 000 p.a.
: aplicando gastos unitarios posteriores al mejoramiento del camino	102 500
(ii) Ahorro en el volumen adicional de mercaderías	102 500
(iii) Ahorro en el volumen total	$277 500 p.a.

V. Beneficios económicos mensurables por el aumento de producción e intercambio comercial

En miles de dólares anuales

	Precios Ordinarios	Precios Constantes (Primitivos)
1. Valor de las ventas al por menor después del mejoramiento del camino		
10 000 unidades primitivas a 90 dólares	900	1 000
5 000 unidades adicionales a 90 dólares	450	500
Valor en el mercado	1 350	1 500
Restar: ventas de las 10 000 unidades originales a 100 dólares antes del mejoramiento del camino	1 000	1 000
a) Aumento en el PNB (antes de tomar en cuenta los impuestos)	350	500
Rebajar: Reserva de 10 por ciento para impuestos	35	50
b) Aumento ajustado del PNB	315	450
2. Aumento en el PNB (antes de la reserva para impuestos)	350	500
Agréguese: menores pagos por el transporte de mayor volumen	72.5	41.7
mayores fondos disponibles para pagar los factores que no sean transporte	422.5	541.7
mayores pagos por la venta	35	50
mayores pagos para la agricultura	387.5	491.7
3. Aumento en el PNB (antes de la provisión para impuestos)	350	500
Rebájese: aumento en los costos totales de producción	215.5	345.5
Aumento neto de PNB	134.5	154.5
Componente ventas	1.75	2.5
Transporte	10.25	13.3
Agricultura	122.5	138.7

VI. Beneficios económicos mensurables por los excedentes del consumidor y del productor

	Precios ordinarios
1. Excedente del consumidor procedente de la venta de 15 000 unidades a 90 dólares la unidad:	
10 000 unidades en demanda efectiva antes del mejoramiento caminero a 100 dólares la unidad	$100 000 p.a.
4 500 unidades en demanda potencial antes del mejoramiento caminero a 91-99 dólares la unidad	22 500
500 unidades en demanda potencial antes del mejoramiento caminero a 90 dólares la unidad	0
Total	$122 500
2. Aumento en el excedente de la distribución procedente de la venta por comerciantes de un volumen 50 por ciento mayor con un recargo igual (10 por ciento)	1 750 p.a.
3. Aumento en el excedente del transporte procedente de mayores márgenes de utilidad correspondientes a un uso más intensivo de los camiones, cargas útiles más pesadas, necesidades de mantenimiento menores.	
10 por ciento de los gastos por un total de 277 500 dólares por 2 035 000 toneladas-milla en el camino mejorado	27 750
5 por ciento de los gastos por un total de 350 000 dólares por 1 250 000 toneladas-milla en el camino primitivo	17 500
Aumento	$ 10 250 p.a.
4. Mayor excedente de la agricultura procedente de la venta por el agricultor de un volumen 50 por ciento mayor a precios de venta más altos	
Productores de la fuente A	35 000
Productores de la fuente B	54 500
Productores de la fuente C	33 000
Aumento	$122 500 p.a.

	Precios ordinarios	Precios constantes (primitivos)
Aumento de excedentes del productor	134.5	154.5
Excedente del consumidor derivado de lo anterior	122.5	133.6 a/
	257.0	288.1

a/ 10 000 unidades en demanda anteriormente	111.1
5 000 unidades que no estaban en demanda anteriormente	22.5
	133.6

VII. Comparación resumida de los beneficios económicos computables por diversas mediciones

	En miles de dólares (redondeados) anuales	
	Precios ordinarios	Precios constantes (primitivos)
A. Ahorro en transporte		
1. Ahorro para la economía nacional (excluido el componente impuestos)		
a) sin provisión para un aumento en el volumen del tráfico	75	83
b) con provisión para un aumento en el volumen del tráfico	158	176
2. Ahorro para los dueños de vehículo		
a) solamente tráfico primitivo:		
i. comprendido componente impuestos	166	185
ii. excluido el componente impuestos	149	166
b) tráfico primitivo más el inducido:		
i. comprendido el componente impuestos	213	237
ii. excluido el componente impuestos	191	213
3. Ahorro para los clientes de los vehículos		
a) solamente tráfico primitivo	175	194
b) tráfico primitivo más el inducido	278	309
B. Mayor producción e intercambio comercial (excluido el componente impuestos)		
1. Aumento de PNB sin provisión para menores gastos en transportar el mayor volumen de mercaderías	315	450
2. Aumento de PNB más ahorro en transporte ajustado al mayor volumen de tráfico	473	626
3. Aumento del ingreso neto real:		
a) antes de tomar en cuenta la liberación de una porción de la flota de vehículos para servicio de transporte en otros caminos	121	139
b) en el supuesto de que la liberación de vehículos fuese igual al 25 por ciento de los costos de transporte de la producción antes del mejoramiento del camino	56	62
TOTAL	177	201

	Precios ordinarios	Precios constantes (primitivos)
C. Mayor excedente del consumidor y del productor		
1. Liberación para otros gastos y/o inversiones del ingreso del consumidor que anteriormente se gastaba en comprar el volumen primitivo de mercaderías a precios unitarios más altos	100	111
2. Transferencia de los ingresos del consumidor (a causa del precio más bajo) desde otros bienes y servicios y/o ahorros	22.5	22.5
3. Generación de utilidades del comerciante, del empresario de transportes y del agricultor que quedan disponibles para mayores inversiones y/o desembolsos	134.5	154.5
TOTAL	257	288

D. Rebaja en los gastos de transporte más mayor producción e intercambio comercial atribuibles a las inversiones en transportes

	Precios ordinarios
1. Ahorro en transportes (costos de producción) con respecto al tráfico primitivo	
- precios ordinarios (neto, sin impuestos)	$149 000 p.a.
- precio constante (primitivo)	166 000

2. Composición supuesta de la inversión incremental requerida en las instalaciones de transporte y agrícolas

Total	100%	100%	100%
Construcción del camino y flota de vehículos	75	50	25
Producción agrícola	25	50	75

En miles de dólares anuales

	Precios corrientes	Precios constantes (primitivos)
3. Aumento del PNB	315	450
Atribuible a inversiones en transporte que se supone que constituyen el:		
- 25 por ciento de la inversión total	79	112
- 50 por ciento	157	225
- 75 por ciento	236	337

	Precio ordinario	Precio constante (primitivo)
4. **Beneficios económicos atribuibles a los caminos mejorados**		
Suponiendo una proporción de inversión de:		
25 por ciento	228	278
50 por ciento	306	391
75 por ciento	385	503