

(A) MAKERERE INSTITUTE OF SOCIAL RESEARCH

(#31)

(b) Rural Development Research Project

R.D.R. No. 109

9th February, 1971

Hans Jahnke

Aldo Matteucci

CONTROL OF TSETSE FLIES AND TRYPANOSOMIASIS IN EAST AFRICA  
- FRAMEWORK FOR AN ECONOMIC EVALUATION -



Note: Rural Development Research papers are written as a basis for discussion in the Makerere R.D.R. Seminars. They are not publications and are subject to revision.

Control of Tsetse Flies and Trypanosomiasis in East Africa  
- Framework for an Economic Evaluation -

I. Introduction

Diseases, in Africa South of the Sahara, have long been recognized as being among the major factors shaping the environment of man. Among them, the diseases described by the collective name of African Trypanosomiasis are considered to be most significant. This is due to

- the multiplicity of their impact on man; the pathogenic protozoa (Trypanosome spp.) are responsible for (i) Gambiense Sleeping Sickness, (ii) Rhodesiense Sleeping Sickness and (iii) Nagana. The first two are diseases of man, nagana or veterinary trypanosomiasis is a disease to which most domestic animals succumb; a major source of man's livelihood is thus threatened;
- the wide distribution; characteristically the transmission of the disease is effected by a blood-sucking insect, the tsetse fly (Glossina spp.) wild vertebrates usually constituting a permanent trypanosome reservoir. This fly is spread over millions of square miles in Africa with the resulting incidence or threat of trypanosomiasis.

Over the years various techniques based on different principles have been developed to combat the disease and its vector. In the East African countries permanent institutions have been established to deal with the problem; millions of shillings are spent every year to protect human health to make production possible in areas infested by the tsetse-trypanosomiasis complex (TTC) and to reclaim areas from the tsetse flies.

In a study presently being carried out we are trying to assess the economics of measures taken in the past against the TTC. In this paper we attempt to outline the framework for an economic evaluation by laying down the context within which we shall deal with the problem, the principles of the evaluation technique we intend to apply and by pointing out ways to overcome some of the more obvious difficulties in such an evaluation.

II. The Relevant Context: Tsetse and Trypanosomiasis as a Problem of Land Use.

Stating the content of a problem determines to a large extent the scope of the examination and the range of alternative approaches considered. The crucial element determining the approach to the solution of problems presented by trypanosomiasis is its link to a vector, the tsetse fly, which itself is present only in rather well defined ecosystems.<sup>1</sup> Thus the existence of tsetse-suitable areas determines on the whole the distribution of the disease, making the potential or actual presence of the latter <sup>a characteristic</sup> of the land. Viewing the presence of the disease complex in such a way, the choice of a strategy against trypanosomiasis becomes part of the overall economic problem of the use of a particular area, i.e. the choice of strategy will be dictated by the form of land use which will yield the highest net returns from the resources invested.<sup>2</sup>

Presence of the disease is but one of the many factors determining the use of land: many others belonging to different categories play a relevant role as well. It appears necessary to briefly expound on them to indicate the complexity of the decision making process called for.

1. Factors Affecting Land-Use.

The concept of land has been defined as the

"sum total of the natural and man made resources over which possession of the earth's surface gives control".<sup>3</sup>

As such, land is a heterogeneous resource the use of which characterized by many factors. One may distinguish three major classes of factors:

- (i) Physical and biological (actual) factors like soil characteristics, rainfall, availability of water, topography, geographical (fixed) location, presence of disease and presence of natural resources like game, forests, minerals determine the objective framework on which land use depends.

---

<sup>1</sup>. Non-ecosystem bound spread of trypanosomiasis (mechanical) transmission) is found as well, but its impact is overshadowed by the former.

<sup>2</sup>. It is important to remember that different forms of land use allow for differential treatment of the problem. Thus by choosing a form of land use not affected by the disease complex, one may avoid the constraint altogether. Alternatively, the permanent transformation of the tsetse ecosystem may appear profitable. Under certain conditions the change of a single element may be preferable (e.g. reduction of fly populations through insecticides).

<sup>3</sup>. Barlowe R. (1958) p.7

(ii) Technological factors, that is, the set of technologies available, at any point in time, to exploit and combine the physical factors determines the range of possible land uses open to society.

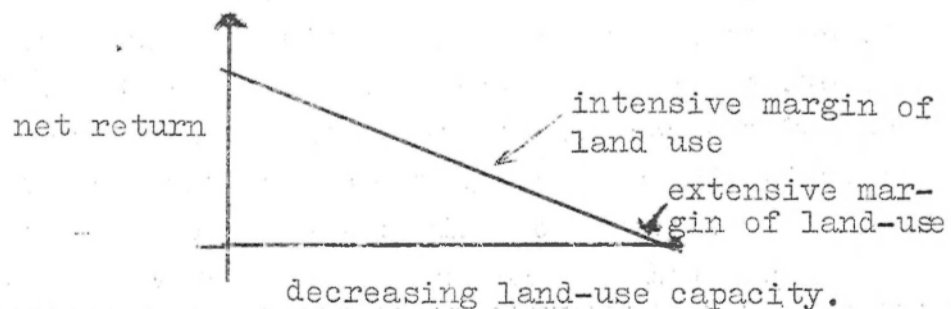
(iii) Socio-economic factors. Prices of the inputs which are combined with land to yield desired outputs and the value of the planned product will affect preponderantly the decision of the rational economic man with respect to patterns of land use. Social customs, attitudes and beliefs often play an equally important role. More so, economic institutions, that is "institutions that affect economic behaviour directly"<sup>1</sup> by determining and shaping the economic signals (prices) to which the economic man reacts, have a profound impact on land-use.

Finally, the historical past use of the land will be a determinant in as much as transformation costs and the existence of sunk costs will play a role in the decision. Thus a whole complex of factors determines land use. It is the aim of land economics to determine the most economical pattern of land use.

## 2. Land Economics.

Land in its most general form is a natural resource, that is an unproduced input to the productive process which is in limited supply. As land in itself is not productive, but yields output only when labour and capital are applied to it, its value (price) is a derived value, i.e. stems from the value of production it makes possible in combination with other resources minus all the costs that have to be incurred. We shall provisionally call this value the "net return".

As the many physical and biological of land make for an heterogeneous resource, it is possible to distinguish land units according to an index of land use capacity, that is of the ability of land to produce returns above costs for any particular type of land use. A graphic representation of the index can be shown:



---

<sup>1</sup>. Ciriacy-Wantrup S.V. (1963) p. 141 .

The cut off point in the index is determined by the extensive margin of land-use, that is 'that point in a continuum of land areas with decreasing use capacities beyond which it does not pay to bring additional land into production'<sup>1</sup> for that particular use. The position of different types of land in the index is determined by that factor combination beyond which it does not pay to apply more variable inputs; this limit is called 'the intensive margin of land use'.

Given a certain type of land, its value will be determined by the highest net return that can be secured through any type of use.

In many instances land of a determinate quality is not fully inelastic in supply; additional units are available at cost. These costs, the conversion costs, are needed to offset undesired characteristics (e.g. presence of the T.T.C), or to increase the supply of a desired element (e.g. water). The problem of maximizing returns from an available unit of land then becomes one of optimal allocation of resources between two processes; land resource development and final output production, where the first is input to the second. Given a fixed amount of resources that can be devoted to the conversion, or given at least the costs at which the necessary resources for conversion can be obtained (limited vs. unlimited budget) the aim is to obtain overall maximum net returns on investment.

A consideration may be added at this point: land enters the productive process as a complex of characteristics: the change of one or even many of them may not affect its overall productivity if further limiting characteristics exist. Thus, while we may be interested in determining the best use of land after elimination of the TTC, one should be aware that without additional improvements (conversion costs) the unit of land may still have a very low productivity.

It would obviously constitute a formidable task to calculate the net returns from all types of land through all possible uses accounting for all possible conversions to arrive at a general optimum: attempts in this direction would have to be undertaken by developing general equilibrium models. In view of the known severe restrictions presently limiting the usefulness of such models<sup>2</sup> and of the uncertainty about the usefulness of a static equilibrium solution for an economy under structural change, it appears that, when considering specific problems of land-use and land resource development we can never hope to achieve the 'best of all' solution.

---

1. Barlowe R. (1958) p. 144-147

2. e.g. Henrichsmeyer (1966).

By necessity we are forced to undertake a partial analysis, that is to confine ourselves to allocation of resources in a particular area of investigation, assuming the socio-economic environment as given, and a set of economic goals as axiomatic. Doubts have been voiced as to whether a partial analysis will ever result in an overall improvement.<sup>1</sup> We believe however that the forthcoming quantification of coefficients, the compilation of data and the highlighting of so far unnoticed aspects is justification enough. Furthermore, while we may not be able to indicate unambiguously preferred strategies, it will be quite possible to gain some idea of the economic worthiness of strategies through an analysis of projects carried out in the past.

### III. Principles of Economic Evaluation

The size of the area infested by the tsetse-trypanosomiasis complex in East Africa and the substantial threat which occurred at times in the past to human health and economic activities have resulted in the establishment of permanent institutions, in each country, dealing with the problem.

As a result, a pattern of action has evolved over the years which may be referred to as an 'action policy'. An economic ex-post evaluation then has to proceed on two levels: (i) a review of the overall pattern (policies, strategies) and (ii) a review of individual elements (projects, tactics). Based on a consistent set of objectives one may imagine a comprehensive evaluative scheme which permits integrated assessment of the parts and of the whole; for conceptual and practical reasons such an integrated evaluation does not appear possible.

Evaluation of individual elements (projects) has received more attention from economists. Thus more concrete (if not more objective) tests of economic worthiness have been developed, although there is still a range of conceptual and practical difficulties, particularly when these tests are applied to a developing economy.

Assessment of overall policies then remains very often a task for which intimate knowledge of the economic worthiness specific projects is a necessary but not a sufficient condition.

In the following sections we attempt to outline the principles that will guide us in the evaluation of individual activities or projects. From their application to concrete historical situations we shall hopefully obtain the basis for an evaluation of overall past policies.

#### 1. The Objectives of an Economy

An economic evaluation of an activity means the assessment of its desirability in the light of a given objective or set of objectives.

As the ultimate objective of an economy we may safely state the 'maximisation of the aggregate economic welfare of the society' (in short: social welfare). Economic evaluation means then assessment of the contribution of an activity to the social welfare. Under certain conditions (which are the conditions that bring about a coincidence of individual and collective interest i.e. of profit and social welfare) this contribution is equal to the ratio-

nal income generated by the activity. This however only holds if the initial distribution of income is deemed acceptable. Only then can the prices that enter income valuation be taken to reflect the true wants of society. Conventionally the two elements i.e. size of the national income and distribution of the national income are treated as separate objectives of the economy:

- i) increase of the national income
- ii) equitable distribution of the national income;

Generally it is assumed that the distributive objective is taken care of by instruments of economic policy other than project selection so that project evaluation may focus on the income objective only. The validity of this assumption is doubtful, particularly in developing countries. The distribution of income is generally viewed as unsatisfactory by the government; at the same time, however the government's willingness and ability to use other instruments such as taxation and subsidization is limited. Project selection may then have to play an explicit part in promoting greater equality. In the following we shall however mainly concentrate on the income objective.

## 2. Social versus Market Evaluation

A project will entail a gross contribution to the national income (benefits) and a reduction of the national income through diversion of resources from alternative uses (costs). A project will result in an overall increase of the national income if the stream of benefits over time is greater than the stream of costs. How then can we determine the costs and benefits of a project? Do the terms expenditures and receipts we are used to in private accounting coincide with the terms costs and benefits as defined above?

Expenditures and receipts can be shown to be poor indicators of social costs and benefits for various reasons some of which are of a general nature while others are typically associated with conditions of economic backwardness:

- (i) In a developing economy market prices do not reflect social valuation because of disturbing factors like inflation, currency overvaluation, unemployment, imperfect capital markets, deficiency in overall savings etc.
- (ii) Benefit and cost streams occur over time. An intertemporal weighting has to be made for which in private accounting the market rate of interest is used. It can be shown that this rate is usually unsuitable for social evaluation.
- (iii) Market prices do not reflect true scarcity when the market mechanism fails on account of externalities, indivisibilities and public goods.
- (iv) Several expenditure and receipt items which arise in 'normal' accounting do not reflect decrease or increase of national income but mere transfers within the economy e.g. direct and indirect taxes or subsidization.



As a result, a new set of prices, shadow or accounting prices, may have to be introduced that reflect more closely the value of goods and services to society. It is only then that the net benefit from a project can be considered as a good measure of the value of a project for the society. Little and Mirrlees state: 'the art of Cost-Benefit Analysis is to assign prices to goods and services which do reflect their real costs to society and their real benefits'. Goods and services being revalued with such accounting prices we may then redefine costs and benefits as decreases and increases in 'social income'.

In the following we shall sketch some principles which will guide us in the determination of social benefits and costs. As our study is concerned with developing countries, adaptation to a situation of economic development is of central importance. Little I.M.D. and Mirrlees J.A. (1969) have attempted a first comprehensive re-formulation of the procedures of cost-benefit analysis for developing countries. While their approach is explicitly geared to an evaluation of industrial projects we believe that it is to a large extent similarly applicable to agricultural projects.

### 3. Establishing Benefits and Costs

Of the factors we have listed before, the valuation of goods, and the weighing of consumption streams over time in a developing economy appear to be central, and shall receive proper attention now.

#### 3.1 Prices in a Developing Economy.

One of the major characteristics of a developing economy is the fact that the range of outputs is far from complete: while often most consumption goods may be home-produced, intermediate and capital goods have to be imported from abroad. This is to say that in the short run both the total production capacity and its structure are inflexible.

Given an essentially low elasticity of demand for the major exported goods and a relatively small import of consumption goods, assuming domestic production at full capacity, and consumption stabilized at politically acceptable levels, the capacity for output expansion becomes a function of the available foreign exchange.

In other words, if no excess capacity exists, if savings cannot be increased in the short run, if the amount of foreign exchange is fixed by international prices, the latter resource becomes the limiting factor crucial to investment decisions.

A shortage of foreign exchange implies that domestic goods are overvalued with respect to imports. Account of this fact has been taken in the past by introducing a 'shadow ration of exchange' <sup>1/</sup>

---

<sup>1/</sup> So that a balance between demand and supply could be achieved.

by which imports were revalued. While direct foreign exchange costs and receipts have thus been considered, it appears that such an estimation may in point of fact be misleading. For, under the assumptions quoted above, every output can either be directly or indirectly exported or used for import substitution. The converse, of course is true for inputs. It follows that for all traded goods, that is for all goods which are actually (and potentially) acquired (sold) abroad, world market prices in world currency to be used.<sup>2/</sup> As it may be difficult to trace the world price for each individual good, a standard conversion factor, based on the ratio of world prices to domestic prices may be calculated.

Particular difficulties arise with non-traded goods, like labor, land, internal transportation, for which no international prices can be established. Leaving the matter of wages to a later point, consistency requires that we value local goods in terms of their contribution to foreign exchange. This may indeed be possible, for

"following the chain of production around, one must eventually end at commodities that are exported or substituted for imports."<sup>3/</sup>

Here again, conversion factors may be used to facilitate the evaluative task.

Summing up, we shall attempt to evaluate outputs and inputs (except wages) in the following way:

- (i) Identify traded goods. Determine their world prices and derive from them the total costs or benefits.
  - (ii) Identify the non-traded goods. Determine their 'world price' by multiplying their money value by an appropriate Standard Conversion Factor.
- Consideration should be given to changes in the prices over time, and care ought to be taken that trends be properly ascertained.

### 3.2 Accounting Wages.

A special problem is presented by wages. While skilled labor may be, up to a certain point, classified as 'tradeable' and thus subjected to the same principles as traded goods, unskilled labor has no world price. It has been often held that the real cost to society of shifting employment from the traditional sector to preferred uses is the marginal loss of production. As in many economies the marginal product of labor is very low, the real cost of labor is deemed to be minor. This assumption, in view of Little and Mirrlees, is somewhat misleading. The introduction of labor into the wage-economy implies an increase in consumption which, assuming full employment of the resources of the economy, cannot be satisfied but by diverting, directly or indirectly, some foreign exchange from investment. In other words, the use of labor for development projects has, as a consequence, reduction of total investment, for scarce foreign exchange has to be used to satisfy the consumption. Thus the real cost of wages must be higher than the conventional opportunity cost of labor, even if not as high as the full monetary wage.

---

2/ In practice this means f.o.b. and c.i.f. prices respectively.

3/ Little I.M.D. - Mirrlees J.A. (1969) p. 93.

An alternative way of explaining the reasoning is to point out that future consumption will be function of present investment. If the total capital available is restrained by the need to satisfy present added consumption generated by investment, a tradeoff between present and future generations needs to be established.

It is worth while to mention that added consumption will limit investment only if worthwhile projects have to be postponed. Thus the shadow wage is a function of the rate of interest which makes the present social value of marginal projects 0. The latter rate is in turn a function of the shadow wage, which influences social value.

Theoretically both values ought to be determined simultaneously, while in practice overall consistency is sufficient.

### 3.3 The rate of Interest.

One of the most controversial points of classical Benefit-Cost Analysis is the choice of the interest rate. Without going into the details of the highly technical discussion, we can say that two schools can be distinguished: those who want to use the going longrun market rate as the expression of collective intertemporal weights, and those who deny any relation between a social and a private rate altogether, and thus calling for governmental fiat.

Both approaches have their difficulties in a developing economy: the private rate of interest may have little to do with social evaluation of future consumption streams, based as it is on high risks, which have no place in public evaluation.

Ignorance, monopoly elements in the supply of money may add to the call for extensive reassessment, thus making the initial value quite useless.

A centrally established accounting rate of interest which would ensure full use of national resources would be difficult to calculate and in fact has very seldomly been established in developing countries.

Therefore, we basically take a rather empirical position, and shall assess the activities with different rates of interest, to see their stability under alternative assumptions.

### 3.4 Market Imperfections, External Effects, Secondary Benefits.

The theory of Benefit Cost Analysis is based on the assumption of a perfectly operating market system, with smooth functions, correctly allocated benefits and costs, and absence of public goods. Reality, of course, particularly in a developing economy, is fraught with such imperfections, so that appropriate account of them has to be taken.

Basically no different procedure has to be adopted from the standard methodology, as outlined by Ekstein O. (1958), provided that the pricing methodology suggested before is adopted, and then adjusted according to the particular situation. This is nothing but to say that prices ought to be selected in such a way as to reflect, as much as it is possible, real value to society.

A different matter altogether is the contention that 'secondary benefits' arise to the economy because of the expansion in complementary industries,

be it on the input or output side, increases income in these subsidiary sectors. Here a few considerations must be made:

- any project will yield a similar value of secondary income in proportion to its size, so that these benefits can be excluded for comparative purposes;
- the assumption that the productive capacity of the economy is fully employed precludes the possibility of substantial secondary incomes;

In particular as far as commercial projects are concerned (i.e. the product is sold on the market) we are most apprehensive as far as justification of the project with large secondary income is concerned.

Another point of argument concerns non-quantifiable external effects: i.e. effects which do not accrue to those involved in the production processes of the project but to third parties. In this context the 'demonstration effect' has often been given particular emphasis in developing countries. This effect refers e.g. to the spread of a new technique in an area after it has been introduced through a pilot scheme. While such effects may indeed exist, it appears that they often have been overstated. After all experience shows that the introduction of advanced agricultural technologies has led to a dual system of agriculture rather than an overall improvement. This is mainly due to the fact overall adaptation of new techniques to local conditions is more difficult than anticipated. It is therefore felt that unless exceptionally good evidence exists for such a demonstration effect we can safely neglect it for our study, or at the most give it some descriptive treatment.

#### 4. The Benefit-Cost Criterion

Having established the costs and benefits of the projects under consideration, we want then to arrive at a single-valued criterion which shows us the economic worthiness (social profitability) of the respective projects.

In an ex-ante analysis the choice of the criterion depends among other things on whether one is dealing with a limited or an unlimited budget. In the latter case it is sufficient to establish the net benefits accruing over the years, and discount them back to the starting point. A positive present value indicates profitability.

In a developing economy, however, it appears unwarranted to assume unlimited budgets; it is thus more appropriate to use either a benefit-cost ratio or to calculate the internal rate of return.

As our evaluations are to give an indication of the economic worthiness of certain strategies and types of projects for the future we shall adopt the latter approach.

Arguments can be put forth for either criterion (i.e. cost-benefit ratio and internal rate of return). At this stage no clear-cut case can be made for either, and, essentially, experience has to accumulate before their relative suitability for choice in developing countries can be assessed. Particularly useful appears the comparison of the two criteria in ex-post analysis, because the availability of historical data allows us a more precise evaluation and a better identification of the relative biases. We shall therefore as far as possible employ both criteria.

III. Special Problems.

(a) Health - The presence of the TTC may affect human health in two principal ways (1) through incidence and threat of sleepingsickness and (2) through malnutrition, in particular protein deficiency, caused by the effect of the TTC on production.

Health, production and economic development are certain interrelated and one may try to establish in quantitative terms the economic effects improved health brings about. We do not adopt this approach since it appears impossible to quantify this relationship with any degree of certainty and since this approach still only considers the "economic worth" of man. Instead we adopt an "alternative cost" approach.<sup>1</sup> This needs explanation and justification in the context of the two sets of effects on health.

(2) Incidence and threat of human sleeping sickness. We assume that an activity in the past has been concerned with the elimination of sleeping sickness. The point of argument is then whether we can assess these benefits in economic terms. Our argument is guided by the following considerations:

- overall incidence of sleeping sickness in East Africa is low (about 1,000 new cases per year in a population of over 30 Mil.),<sup>2</sup> the cases occur fairly localised;
- sleeping sickness is typically not a debilitating disease with a long run effect on the productivity of an individual, but a killing disease so that the threat is to human life per se.
- while incidence of sleeping sickness is low, it always implies the danger of an epidemic, in particular since the epidemiology of the disease is not fully understood.

From this we conclude that while the economic consequences of the disease may be negligible control is absolutely necessary, i.e. some action against the disease is certain to be undertaken.

---

<sup>1</sup>. Eckstin (1966) p.52

<sup>2</sup>. WHO (1969).

- Furthermore: - in hardly any circumstance will we be confronted with projects concerned with human sleeping sickness alone; rather we are usually dealing with situations where sleeping sickness is but one component of the total effect of the TTC and thus the control of sleeping sickness is only one component of the benefits from the project;
- there are alternative methods of dealing with the problem of sleeping sickness;

We therefore propose to assess for any particular situation the most economical method of dealing with sleeping sickness. When trying to evaluate a multipurpose project concerned with health and human life as well as with promoting the cattle industry etc.; the benefits from controlling sleeping sickness are accounted for in terms of saved costs i.e. costs of the alternative (cheaper) method of controlling sleeping sickness.

E.g. Tsetse Control in Sleeping Sickness Area

present value of costs	10,000	(tsetse control)
present value of benefits	5,000	(increased meat production)
" " " " (alternative costs)	10,000	(costs of re-settling 100 people in tsetse free country)
SOCIAL PROFIT	5,000	

the project is undertaken and justified since economically viable.

(b) Protein deficiency

Some tsetse control projects have been justified with the argument of protein deficiency. The presence of tsetse prevents people from holding cattle and to a large extent eliminates beef and milk from their diet resulting in mal-nourishment and particularly in protein deficiency.

Protein deficiency is a disease displaying a typical and strong inter-dependence with economic development and productivity. How can our evaluation procedure account for this aspect?

Again a number of considerations guide our approach:

- for Uganda number of studies have been carried out concerning protein requirements, protein availability and protein intake;<sup>1</sup> to our knowledge an overall protein deficiency has never been established;
- under the present diet structure as determined not only by the productivity of the environment but to a more important extent by social customs a deficiency of some essential amino acids for certain sections of the population in certain parts of Uganda may be justly assumed;
- while we recognise the high biological value of animal protein we also recognise that the deficiency exists among the poor and among the uneducated;
- relief measures must therefore consist of health education and provision of the cheapest possible sources of those amino acids lacking;
- it has been pointed out that the cheapest source for those amino acids presently lacking are crops; in most cases therefore a change in the cropping pattern is sufficient; alternatively expansion of fish production, provision of toned milk and game utilisation offer possibilities of dealing with dietary deficiencies efficiently.

In conclusion we are therefore strongly apprehensive of justifying large-scale tsetse control operations with the argument of a protein deficiency. <sup>if</sup> This may not only lead to the execution of uneconomic projects, but is also likely to conceal the actual causes of mal-nutrition, poverty and lack of education. In the light of these considerations it appears all the more important to assure that tsetse control projects and attempts to promote the cattle industry be economical.

It will only be in well-defined specific situations that we may allow the protein argument to enter our economic evaluation of a project (possibly for the Bunyoro operations in Uganda). In such a case the alternative cost approach will be chosen. In other words we try to estimate the costs of the cheapest method of relieving a protein deficiency and then credit the project under concern with additional benefits equal to the value of costs avoided.

---

<sup>1</sup>. Cleave (1968), Gale (1960), Payne (1963), Amann (1970) McDowell (1970).



## 2. Increased Production and Economic Development

The type of economic evaluation we want to apply to tsetse and trypanosomiasis control projects ought to be adapted to conditions in developing countries and is to emphasise the necessity for economic development. Since however the criterion of economic worthiness is to a large extent based on the income or production generated by a project we fear that not in all cases will the criterion show the preferredness of a path leading to economic development as compared to one which merely leads to a short-run increase of income.

It is common practice to regard any economic activity in developing countries as a measure related to economic development. We do not take this view. Rather we distinguish between a mere increase in production or income and economic development which may be defined as "a modification of the economy in such a fashion that growth becomes a regular feature of the economy"<sup>1)</sup> ("growth" referring to a mere increase in production or income). Thus, development describes a wider process, implying changes in attitudes, in the institutional and social environment. It describes a long-run process, namely the change in "the characteristics of an economy responsible for its 'growth-generative' powers over a long period of time".<sup>2)</sup>

To bring the matter within the scope of our study we may cite some examples:

a) Opening up land for traditional husbandry through tsetse control may have identical results in the project evaluation as allocating the cleared land to individuals i.e. creating a system of private ownership of land at the same time. This is so because the time horizon in our evaluation is limited. The latter process however provides the pre-requisites for further increases of income through pasture improvement, increased personal incentive, possibility of obtaining credits etc. In other words although the latter project may be much more growth-generating in the long run our economic criterion may not be capable of accounting for this.

b) Tsetse control has been carried out with the argument that tsetse infestation has limited the amount of land available for livestock production and resulted in overgrazing and degradation of the remaining areas.

The economic evaluation of this tsetse control scheme may well show a considerable increase in production and income on the new land made available. On the other hand we may very much doubt in how far the scheme has contributed to the development of the livestock industry of the area.

Overgrazing and degradation of land are not logical consequences of restricted supply of the resource. On the contrary, one should expect that decreased availability leads to more conserving practices of land use. Thus, pasture degradation is much more an indication of the lack of interest and understanding on the part of the husbandry man. While making more land available will bring about

an increase in production, in the long run, and without additional resources it will only result in more land being overgrazed and degraded. In fact the education of the husbandry man that may have been brought about more easily if carried out under the pressure of decreasing productivity of traditional practices may have been delayed, i.e. economic development has been delayed. It is very likely that this effect will not show up in the criterion of economic worthiness although being of paramount importance.

We draw two major conclusions for our study:

- the criterion of economic worthiness may not give due account to the developmental impact of a project; additional descriptive assessment of this impact is therefore necessary;
- growth and economic development are interdependent; this interdependence may be complementary or competitive in nature; it is especially in the latter case that careful description of the implications of a project for economic development is necessary in order to avoid "dead end" paths.

### 3. Threat of Tsetse Spread

Many of the large scale tsetse control operations in Uganda have been carried out with the purpose of halting tsetse advances and eliminating the threat of tsetse flies spreading into areas that are settled and used but provide a potential tsetse habitat.

The two major strategies chosen in Uganda to counter this threat have been (1) the establishment of defence lines (clearing, agricultural settlement) and (2) preventive reclamation i.e. eradicating the fly from areas that constitute the source of potential infestation.

The question arises whether our proposed method of economic evaluation is capable of adequately assessing the costs and benefits of such projects. This question obviously relates mainly to the assessment of the benefits.

Conceptually the benefits from such projects could be defined as

$$B = p \cdot L + I$$

where B - total benefits  
p - probability of the spread  
L - economic losses associated with the spread  
I - net income from new production effected on the defence lines or on the reclaimed areas

In general it does not appear possible to obtain reasonable esti-

notes for the terms  $p$  and  $L$ . We are not able to assess or post the probability of the spread and even if we assume that the spread would have occurred with certainty (i.e.  $p = 1.0$ ) we are not able to quantify the components that enter into  $L$  (total area threatened, value of production in that area, reduction of production through tsetse infestation etc.).

In some cases it may be possible to circumvent the necessity of estimating potential losses; notably where an alternative cheaper method of eliminating the threat can be assumed to have existed (defence line instead of preventive reclamation, resettlement of the people in the threatened area). In other cases large and complex schemes can be broken down into efforts solely concerned with eliminating the threat and other efforts which are intended to make land available for economic use (eg. in Ankole). Thus for at least part of the scheme a full-scale cost-benefit analysis may be achieved.

In all other cases we will simply have to admit that the economic evaluation does not account for all the benefits of the scheme.

In this context we may, however, recall that the aim of our study is not so much to attach a tag of economic worthiness to all the projects carried out in the past, but rather make use of past experience for decisions to be made in the present and in the future. By 1963 at the latest all major tsetse advances in Uganda had been stopped and threats to the large and important cattle areas had been brought under control. Analysis of projects carried out in the past with the threat of tsetse spread present may have implications for future decision-making in at least three ways:

- the costs and the technical efficiency of various techniques employed may be assessed;
- in the case of preventive reclamation we may estimate the minimum return necessary from the reclaimed land in order to make a project in a specific area using specific techniques an economic proposition;
- we gain some understanding as to why such a threat evolved in the first place. In many cases it will be found that man-induced ecological changes helped to create in areas settled and used by man potential tsetse habitat. This in turn brings the area under the threat of tsetse infestation.

One important implication for future control operations is that by eliminating the fly from certain areas while leaving the potential tsetse habitat untouched man creates the threat of re-infestation himself. Again the impact of the threat is measured by the term  $(p \cdot L)$ . The less one tries to make reclaimed land permanently unsuitable for tsetse and the more one invests into land still potentially suitable for the fly the higher then is the risk of loss one creates.

#### 4. Overhead Costs, Fixed Costs and Joint Costs

In our ex-post analyses of tsetse and trypanosomiasis control we shall encounter some problems of costing which go beyond those relating to the estimation of the social value of the resources used.

##### a) Overhead costs

Having established the costs which are unambiguously attributable to a specific project (direct costs) we may find that this figure does not yet constitute the total costs of the project. Thus in the case of tsetse control the number of man-days and the amount of capital goods spent in the project area we should add a proportion of the overhead costs i.e. costs for administration of the Tsetse Control Department for tsetse surveys, research into control techniques, general supervision etc.

The problem is then a twofold one:

- estimating the value of the overhead costs
- allocating the overhead costs to the various projects

The former can probably be approached by estimating the costs (in social values) of running the departments of the Tsetse Control Department, which will be made up of the costs of staff and of their travelling and transport, of the costs of maintenance of buildings and equipment and vehicles, depreciation and costs of most office services. These costs will be calculated on an annual basis.

The allocation of these costs will then be afforded according to the ratio of project area to the total operations area of the Department in any one year.

##### b) Joint costs

A somewhat related phenomenon exists where we have to deal with multi-purpose projects. Thus bush-control may serve the purpose of eliminating the tsetse flies and at the same time that of improving pastures. In other parts of Africa multi-purpose dipping is employed which is aimed at simultaneous tick and tsetse control. There exists no logical way of allocating the costs to the various purposes.

For our ex-post evaluations this does not present a real problem since we measure the benefits from tsetse control in terms of the total production and possible net of all additional capital and recurrent costs. In other words it is not necessary to divide up the total costs allocated to the proportions to the various purposes for which they were undertaken.

On the other hand the existence of joint costs is important in that it points out the possibilities of joint production. Thus some consideration may be given to the possibility of producing fly-free land through game destruction and simultaneous production of game meat, or to the possibility of considering bush-clearing as a method of producing fly-free land, charcoal and improved pastures at the same time.

c) Fixed costs

Again related to the above but different in nature is the problem of fixed and variable costs.

As fixed costs we define costs that do not vary with type, size or number of projects undertaken. Variable costs conversely are costs that do vary.

The terms 'fixed' and 'variable' are not absolute in the sense that they are an inherent property of certain types of costs. Rather their distinction depends on the time-scope of the analysis. Thus in the long-run perspective (productively capacity flexible) all costs are variable and the more restricted the time-scope becomes the more costs must be considered as fixed.

Again for our ex-post analysis this problem is irrelevant since type, size and number of projects is given. As, however, the ex-post analyses are to serve future planning the distinction between fixed and variable costs has an important bearing in two respects:

- On the project level depending on the type of project (eg. tsetse control technique) we can recognise a certain proportion of the total costs as independent of the size of the project which results in economies of scale. It will be interesting to examine the optimum size of projects (1) under the assumption that a constant return can be obtained from every acre cleared and (2) under the (more realistic) realistic assumption that the returns per acre vary with the total number of acres cleared.
- On the national level the distinction between fixed costs and variable costs explains to a considerable extent the desirable level of tsetse control activities. Once the decision has been made to charge a permanent institution of a certain size with tsetse control the costs of this institution are fixed (this does not only involve the overhead costs of the headquarters but also the staff that is permanently employed and is assigned to a specific project and maintenance costs and depreciation of vehicles that are employed for a specific project but not bought for the exclusive use for that project etc.). Average costs of tsetse control then decrease with number of projects and size of total operations area. We can then try to establish that theoretical size of a department which by keeping all the permanently employed resources in full occupation is consistent with an overall maximum net return from tsetse control.

---

This work is licensed under a  
Creative Commons  
Attribution – NonCommercial - NoDerivs 3.0 Licence.

To view a copy of the licence please see:  
<http://creativecommons.org/licenses/by-nc-nd/3.0/>