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**ROUND
TABLE
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**COST BENEFIT
ANALYSIS**

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

PARIS 1977

ECONOMIC RESEARCH CENTRE

**REPORT OF
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ON TRANSPORT ECONOMICS**

held in Paris on 29th and 30th November, 1976
on the following topic:

**COST BENEFIT
ANALYSIS**

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

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COST BENEFIT ANALYSIS

Michael J. FROST
Metra Consulting Group Ltd.,
London
United Kingdom

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"Read not to contradict and confute,
nor to believe and take for granted,
nor to find talk and discourse, but
to weigh and to consider"

Francis Bacon

INTRODUCTION

"Paradoxically the economist is now being called upon to achieve through his art what the market system was supposed to do by the light of nature". (143)

In all the European countries, Government intervention in the operation of the free market is increasing. This can take the form either of direct State intervention (e.g. through nationalisation) or alternatively, the formulation of rules restricting the freedom of both individuals and companies. Whilst some of these rules are designed to improve the functioning of the market (e.g. monopolies legislation), others are a deliberate attempt to move away from this, so that decisions can be taken on the basis of some general concept of welfare rather than the narrow interest of businessmen. The aim of cost benefit analysis has been to formalise this concept of welfare and use the result as an analytical tool designed to aid decision when :

- "The Government must decide which of its competing programmes most deserve our scarce resources.
- The Government needs a way to test the efficiency of its programmes, in the way that profits and competition test the efficiency of private business activities". (127)

Government intervention has been accompanied by the rapid growth of bureaucratic institutions. Whereas it might be argued that the individual politician can decide questions of allocation of resources by appealing to some intuitive process, this makes it extremely difficult to run a large department. Administrators therefore have looked for rules which might guide the various levels in the hierarchy in the formulation of policy and in the evaluation of routine decisions. Although it is not the purpose of this study to go back in history, it is worth noting that such methods were being applied in the 17th century in the field of medicine, and that the father of modern cost benefit analysis, J. Dupuit, wrote his classic paper in 1844.

Professor Sélif's paradox can perhaps be resolved if we accept that politicians, and presumably public opinion, have decided to abandon pure market economics and the 'laissez faire' approach. Someone must therefore ensure the "evaluation of the results of the measures adopted, if they are to avoid becoming simple acts of

faith, or lead to uninformed criticism". Further, this "must be supported by precise data". (116). It is in some ways the very volume of data now available to administrators and planners which has led to the development of cost benefit techniques. "Indeed, the information explosion made the evaluation explosion inevitable". (34)

In this paper I will first examine the potential benefits that cost benefit methods might achieve. The remainder of the discussion is given over to the reasons why they are, in fact, not obtained.

A. RESOLUTION OF CONFLICT

"The politician is thus the useful insulator between publics and between levels of policy. He engages in what Kenneth Burke called 'secular prayer'; by invoking morals and values that are being dishonoured and circumscribed in behaviour he prevents an open conflict between disputants". (40)

Conflict may be between members of different classes, between producers and consumers, between local groups and national authorities, etc. "The ranking list of individual projects of the individual agency in terms of its own objective or target as laid down centrally, may differ from the ranking list of the central agency for the same projects... This may lead to frustration at decentralised agency level". (42) "A railway administration which did not try to get the biggest possible grant would be neglecting its own interests" (16); these would however not necessarily be those of the tax payer.

An initial criterion for any approach to decision analysis should therefore be that it accepts conflict as normal and is capable of expressing the reasons why the positions of different agents are different. The approach discussed in Section D of this paper and in the appendix has the potential to achieve this success.

Cost benefit analysis takes the consequences of a public sector decision "and evaluates them in money terms in such a way that the individual amounts of money indicate the additional benefits that result to society on the one hand, and the benefits that society sacrifices on the other hand because, as a result of using certain resources for this purpose, these resources are no longer available for the production of goods and services elsewhere in the economy". (61)

One of the most striking things in my own experience of discussion with administrators and politicians, has been an unwillingness to recognise this limitation of resources and to accept the urgent need of methods to allocate them. It has been said of the founder of the United Kingdom Welfare State that "it did not occur to most people, or to Beveridge himself, that the measures he proposed for unemployment relief, health, old age, and so forth could

not be afforded". (71) This was perhaps because the consequences of decisions taken by the State still represented only a fairly small percentage of gross national product. This lack of economic realism will take a long time to change; however, in some areas "a shortage of financial resources and more detailed information about the avalanche of costs... stimulated the Ministry of Transport to block all new projects for underground railways. The planner for this reason has a difficult task to carry out in developing planning concepts that meet social necessity in the long-term and that adapt to the financial constraints in the short-term". (132) In other areas of policy this realisation has yet to come. The Chairman of one United Kingdom local authority recently found no constraints on the building of houses.

A particularly important area in the use of resources is the acceptance of subsidies to public transport undertakings. As recently as 1970, the French Minister of Transport was able to state "that the railway should gradually absorb its deficit which should disappear by 1974". (1) The fact that such deficits have continued to grow has posed such acute problems, that even critics of cost benefit methods are obliged to admit that "given the necessity of somehow determining levels of subsidisation this is a field where limited CBA exercises have usefulness so long as their considerable limitations are recognised". (144)

Many other decisions in transport planning involve considerable use of resources. Designing cars to meet environmental regulations now under discussion in the United States could add 600 dollars to their cost. (112) Similarly, the proposed noise legislation in the Netherlands has been estimated as costing 200 million guilders a year, and some experts feel that even this is a very serious under-estimation. Here CBA has often found itself under attack from both sides. Environmental interests equate it with crude economic reasoning, whereas manufacturers and many politicians see it as a soft option for justifying projects that would never pass a strict financial evaluation.

Many of the policy areas in which cost benefit is used are bedevilled by extreme solutions. Historically, the free use of cars in city centres has been considered axiomatic. "Will the pendulum now swing in the other direction? Should we agree with certain die-hards that the motor car should be forbidden in towns?" (117) Almost certainly both extremes involve a waste in resources and some kind of compromise must be reached. "We need not profess an absolute preference either for the preservation of the environment nor for the acquisition of material goods". (77) "Neither the premise that the automobile can be dispensed with nor the belief that it can serve as the exclusive instrument of urban mobility are likely to be politically feasible or operationally useful". (113)

A particularly acute area of conflict has been between physical planners and policy analysts (usually economists). It is tempting to simplify this by saying that planners have been concerned with the environment and economists with resources. In fact, the division probably goes deeper than this and is much more in terms of creativity (represented by the planners), in conflict with what is seen as hide-bound complacency on the part of the economists. In some of my discussions the accent was also laid heavily on the conflict between the numerate young and the relatively more literary older generation. I think that it is an encouraging sign that both sides of this particular conflict are showing a little more humility. "This does not mean, as it now appears fashionable to argue in certain quarters, that (the planners' objectives) are prima facie nonsense", (99) but rather that planners are gradually becoming aware of the importance of resources. Similarly economists have been forced to admit that their contribution will only be positive if they place their analytical talent at the service of the planning process rather than attempting to set up in conflict with it.

A further dimension to the conflict in transport planning is the position of the individual. "Little attention was paid so far to possible differences in the preferences of the population on the one hand, and the Government on the other". (4) In slightly more philosophical terms, it is sometimes felt that this is a period in history "when a congruence between one's own personal life and the collective direction of all mankind cannot be established without doing violence, either to one's existence, or to one's understanding... we must learn to live with irreconcilable conflicts and contradictions". (58)

Conflicts exist in a wide variety of other areas. Examples that have been pointed out to me include the importance of social groups in forming legislation in the United States (39) differences between transport authorities over the formulation of the Hamburg plan, (38) between British Rail and the airlines over the links to Heathrow and between centralised and decentralised interests in a whole variety of decisions.

The great claim of cost benefit analysis is that by using it "the polarised groups can find a way to diminish the ardour of the issue without having to admit a costly defeat". (40) Of course it is not the only approach that can achieve such results and this issue is discussed in the part of this report on politicians. (Sector I) However, it is the most efficient in terms of providing the greatest well-being for a given volume of resources and this seems to me to be its prime claim for consideration. It will be argued that efficiency is not the only criterion. This is discussed in section D under the heading of income distribution.

B. CONCENTRATION OF POLITICAL DISCUSSION ON THE FACTS

"Of course in principle almost everyone is in favour of more good public policy analysis". (128)

It may be true in America that most people are in favour of extending the area of public policy analysis. However, an experienced operator like Charles Schultze points out that there are a great many people who regard such an analysis as an infringement on their liberty of action, (141) an improper usurping of political judgement and so on. All these views will be rehearsed in some detail in the second half of this paper. However, although many top decision-makers would hate to admit it, the general cost benefit idea has made considerable progress throughout Europe and particularly in the field of transport planning. (86) Several countries have produced guidelines for cost benefit work in the field of general policy analysis. Equally, more routine decisions are covered by such things as the Cobra (142) system in the United Kingdom. (136, 78) In the EEC it has been made obligatory that an estimate of the amounts involved should be attached to any proposal. All these developments are designed to ensure that the political discussion of any project is at least based on a minimum number of facts.

However, the extent to which the methods are in fact used is closely linked to the professional reputation of the analyst involved. In this context it is worth taking a quick look at the position of economists.

Professor Self points out that in the good old days "businessmen did not need economists". (145) To discuss this statement we should distinguish between two possible roles of an economist in the firm. The first is an expert on outside conditions e.g. the likelihood of a rise in the world market price for cocoa. However, the second is more interesting in the context of this discussion; it is the use of a business economist or management accountant whose job it is to point out to the businessman the economic consequences of his actions, e.g. the effect on his profit.

I know from my own experience in this role, that the key issue was knowing when to present the facts to the decision-maker, and to do so in a form that he would accept. In other words a great deal of work was needed to persuade the managing director of the company that the accounting figures that were being shown to him were relevant to his decision. In order to be effective, the accountant needed to have a good reputation.

Unfortunately, the reputation of economists in this context is poor. Much of this appears to stem from the almost complete

lack of consensus among many practitioners on vital aspects of the methods which they should employ. It is of course only natural that analysts should vary over the application of these methods to specific problems but it does not improve public confidence to see that "schisms of economic thought or belief affect all participants in the policy process and tend to line up groups of politicians, administrators, and economic experts in competing teams". (146)

A particularly damaging tendency has been the temptation to enunciate "laws" on such things as the relationship between unemployment and inflation (the Phillips curve) whereas most people would now say that this was nothing more than an empirical observation valid for a strictly limited period of past history. (156) As a result, there now seems to be an urgent need for economists to agree on a basic minimum by way of theoretical approach and to encourage politicians and other decision-makers to concentrate on the facts.

Incidentally, this criticism of the social sciences is fully echoed by many eminent practitioners. For example, Ralph Dahrendorf, speaking at a recent congress on sociology "found that tangible realities had evaporated from the discipline." (163)

Many writers have argued that theoretical differences can be overcome by sufficient transparency of the analysis. By this, they mean that figures should be presented in such a way that the decision-taker can arrange them according to his view of the nature of welfare. Whilst this is undoubtedly desirable up to a point, it can only be carried so far. Decision-makers are not capable of digesting vast volumes of data; the analyst must make selections either implicitly or explicitly so that those facts which are presented can be reasonably assimilated. To do this he requires an adequate theoretical framework.

C. LIMITING ANALYSIS TO REASONABLE PROPORTIONS

Tracing the consequences of an act of public policy can be a formidable business. For example, if a Government decides to subsidise aluminium production and if this subsidy is used to lower the price, there is an immediate effect on the consumption of the metal throughout the economy. (85) Even if it were possible to assemble data on these primary effects and on the other changes resulting from them, the decision-maker would be overwhelmed by the resulting volume of data. This problem "must be overcome ... because without such measurements we would very often not know whether certain side effects had exceeded an only qualitatively determined effect or not". (124) In practice this reduction in volume is achieved by transforming economic effects on individuals

into terms of the economic effects on organisations (85) and then making an assumption, which may go under a wide variety of names, but which we shall call the optimum management of businesses or governments (another common label is that producers surplus is zero). The conditions for making such a transformation are that resources are fully employed and that the economy is closed. Obviously, in many industrialised nations the first of these assumptions is now open to considerable question, particularly as regards unemployment.

Clearly, the results of relaxing such assumptions are to increase the scope of the analysis and thus the cost of any particular investigation. "However, even if valuation of benefits is not totally comprehensive and there remains a need to trade-off between money valued benefits and real benefits, at least the application of CBA has reduced the dimension of the problem and made it easier to consider the range of choices". (21)

Here we are not referring to the dimensions of the final criteria i.e. whether the welfare function can be reduced to a single monetary value or not. The question is rather concerned with the amount of data which is required before an evaluation takes place at all, i.e. the scope of the study budget.

Even if we do not feel able to carry the analysis through to a single net present value type of criterion, the cost benefit approach can be particularly useful in organising data so that it can be more easily comprehended. A common method of doing this is the use of multi-criteria methods; these range between those using a large number of measures (87) and the suggestion that effects can be grouped into three areas, social, technical and environmental. (76)

D. THE THEORETICAL PROBLEM

"A plan to resist all planning may be better than its opposite but it belongs to the same style of politics". (102)

Policy analysis can take place at two levels:

- a steady accumulation of factual knowledge designed to develop policy over a fairly wide range of activity e.g. a National transport plan ;
- one-off attempts to diagnose a situation in the light of the data that happens to be available. Very often this takes the form of crisis management.

The attitude towards planning of the first kind varies a good deal among the member countries. So does the willingness to undertake what might be described as speculative research. It would be altogether invidious to try and establish any kind of national

pecking order; furthermore my experience in preparing this paper has shown me that analysts in most countries would place theirs at the bottom of any such order. However, some extensive planning studies have been undertaken, a particularly successful one appearing to be the 2,000 exercise in Holland. (74) This scepticism towards planning is, however, not reflected in much of the technical literature. For example, an earlier Round Table felt able to state that "it seems useful and even necessary in the best interest of the community that the decision-making process should be guided by an overall plan". (17) A variety of reasons are given for the unacceptability of planning among politicians. These range from the nature of the political process itself (our successors will reap the benefits) to a feeling among some older people in the United Kingdom that plans are nasty foreign things only to be indulged in by second rate Middle European countries.

The value of plans is particularly apparent in situations where crisis measures might otherwise be resorted to: "in practice, however, planning tends to be ignored. It is most difficult for top executives to give up the immediate services of their more valuable people to do the planning. The natural tendency is to call on them every time there is the slightest sense of urgency and many crises occur in staccato fashion in the top levels of every large institution, including nations". (84) To some extent, this deep-rooted objection can be overcome by flexibility; undoubtedly, a great deal of damage has been done to the concept of planning by the architectural concept of a design year. This has led to many plans being produced which have only been partially executed. The planners never revealed the fact that the suffering while the planning year is being reached can be high. Furthermore, the result of partial implementation may be very much worse than if there were no plan at all. "However, flexible planning does not mean flexibility with no planning at all, unfortunately a common practice; on the pretext of adjustment to changing circumstances, every guideline and the future shape of things is left to random impulses and conflicting decisions". (18)

At any event, the results of hostility or scepticism towards planning are of great importance when considering cost benefit exercises. Other than for low level decisions of the routine type, cost benefit requires a fairly sustained effort of experimentation, data collection, analysis and monitoring; this is only likely to be available in the context of a plan.

A second reason for the rejection of the cost benefit approach lies in its relationship with economics or, more important what economics are perceived to be. The attack comes from two sides:

- the accounting/Ministry of Finance view that financial evaluation is already difficult enough to apply without getting involved in the additional sophistication of cost benefit. Here we meet a rather depressing view that the allocation of resources is already like haggling in an oriental bazaar and that any input of facts must be on a very simple basis. Holders of this view would argue that getting politicians to recognise the cash costs of their actions is already such a significant achievement that it would be unfortunate to jeopardise it by going further ;
- opponents of economics who argue that "amidst the search for better quantifying techniques the overall objectives of the planning process are invariably lost to view. Because the objectives of planning are inevitable qualitative, it is precisely to the unquantifiable that we should be paying attention." (149)

The analyst could answer the first series of critics in the following way: pure financial criteria will never be accepted by politicians as they so obviously leave out enormous areas of public interest, e.g. the notion of service. Therefore, the only solution is to go straight to a more sophisticated measure which at least attempts to evaluate welfare. The argument in the second case is far more complex and must take into account very deep seated feelings.

Many administrators, politicians and academics outside the field of economics are extremely wary of "social welfare function imposed upon society by the philosopher/economist". (147) However, in many cases, this economist is assumed to have an extremely limited outlook and to believe that "the benefits (of public policy) are approximately the difference in national income, with and without the projects". (91) It is said that such methods "may represent the.... disastrous triumph of economic rationality over the political and social rationality, which reasonably, logically and necessarily belong in Government decisions on resource allocation". (159)

Such views as these represent the economist as being impervious to anything outside the market system and are perhaps confirmed by the publication of reports by Departments of the Environment entitled "Cost Benefit Studies", which are similarly limited. (13, 35). Even the standard EEC report on the subject states that "in addition to the traditional criterion of maximisation of the measured social product and to the more specific problem of financial balance, we suggest the consideration of four main categories of effects, namely:

- regional planning of spatial integration ;

- distribution of income, of employment and social integration ;
- industrial and technological development ;
- the environment. (43)

The truth is that any cost benefit analysis worthy of its name should assume that "anything that is sought after by individuals, by society, by governments, i.e. by the decision-makers, has positive value". (98) The fact that it has no price tag attached to it does not classify it as "non-economic". Although "we need to develop an economics which allows for the advantages of variety and individuality and which takes into account the whole costs of actions, reactions and interactions" (151), this is hardly new. As Professor Klaassen pointed out, "no responsible economist would ever be prepared to say that environmental goods are irrelevant to well-being." (79) He goes on to quote Pierson that "if a value is put on air, on sunlight, drinking water, friendship, art, then one simply states that these things must be classified as goods". Although economists have said these things for a long time they singularly failed in putting them over to politicians and other decision-makers; indeed, some of them have singularly failed to apply what they said.

A further complication which has bedevilled the economist's role in CBA is the confusion between micro and macro-economics. This is particularly damaging in view of the doubtful reputation now enjoyed by the latter. For example, it is rightly said that "CBA claims to be a macro-economic investment criterion" (137) because its derivation is in terms of effects on the community as a whole. There is, however, an important distinction between the criterion used (and the way in which this is derived) and the kind of problem on which the method is used. In the latter sense, there should surely be no question that we are talking about micro-economics.

A second reason for rejecting the whole idea of cost benefit analysis is based on a belief that in it "there can be no place for preference that is not rational preference and all rational preferences necessarily coincide". (103) Such an assumption would be absurd and is clearly a gross distortion of the way in which a correct cost benefit approach is derived. This is a matter which will recur at several points throughout this paper, at this point we will simply remark that such beliefs among the opponents of the method are extremely widespread.

A third general reason for rejecting this form of analysis is to quote the superior merits of an alternative. In that so much criticism is essentially destructive, this is at least welcome to a certain extent. However, the alternative, the engineering standards approach, seems to me to have extremely grave disadvantages when applied to environmental problems in the field of transport.

Historically, standards of this kind were useful in dealing with 19th century health problems and it was natural that town planning should inherit some of the ideas that were developed then.

However, when dealing with such things as the impact of noise "even if agreement could be achieved, the approach must be recognised as being conceptually defective. For it treats what are essentially continuously variables characteristics as though they were discrete. Any higher level of service than the bare prescribed minimum is ignored". (44) Whilst this objection can be overcome to a certain extent by ensuring that the standard be adjusted over time to adapt to changed consumer tastes (or income levels) this then loses the main advantages of the rigidity and incontestability of the standard. More specifically, engineering standards seem to me to be open to criticism because little guidance is to be found as to how they should be established. A specific case is the 50/55 DBA proposed in current Dutch noise legislation. Here, and in other similar cases, reference is made to "medical standards". It is supposed that there would be a consensus of medical opinion to the effect that standards exist; if these are not respected people will fail to stay healthy; if they are respected no one will suffer any ill effects whatsoever.

As we will see this approach has been particularly stultifying in the case of the evaluation of noise. However, even if we assume that such standards could be fixed, there is a clear limitation to their contribution in any particular case:

- either a number of solutions would all meet the criteria, in which case we are still faced with the problem of choice ;
- or no solutions meet the criteria.

(It would surely be an extraordinary coincidence if only one solution did). (94a)

This standards approach partly stems from an artificial distinction which has been made between cost benefit analysis (and other so-called "inexact" sciences) and the physical or "exact" ones.

"There are no experts in this field in the sense that there are experts in navigation or thermodynamics". (125) For this reason "it becomes obvious why it is so important to make the distinction... between the methodological position of economics and that of the physical sciences". (157)

"Obviously, there are (no constants) measurable with the exquisite precision of the physicist, and probably none with the permanence which we believe to hold in inanimate nature. Nevertheless, there are some features which are constant enough to warrant examination". (71) Although in one sense these reservations have been particularly necessary (but unavailing), in warning economists and others about the danger of setting up

pseudo laws, such as the Philipps curve, they have had the very undesirable effect of leading to the environment being thought of solely in terms of "medically desirable target levels". (161)

At some stage the analyst has to make an assumption about the distribution of income. For many practitioners and decision-makers this is seen as being a major obstacle. In many cases the political implications of a transport decision are seen essentially in distributive terms; examples are the East-West Express Metro in Paris, the A86 motorway around the city, the fact that "road pricing would continue to be considered by certain circles as favouring the high income groups". (107) In general such distributive problems seem particularly acute when considering regional development or urban transport. In discussing this problem, one is faced with the choice between two possibilities :

- "measures of distribution which can be incorporated in the objective function ;
- the agency carrying out the trade-off" (22) between an efficiency criterion of the CBA kind and equity.

I would agree that many "attempts at expanding the effective definition of cost benefit analysis (to include distribution) have so far failed". (138) However, this is largely for practical reasons rather than theoretical ones. For example at the Roskill Commission very crude attempts were made to adjust the value of time of air passengers downwards and the values attached to noise by relatively low paid sufferers upwards. However, this was not done against the background of any sound theoretical development and it was not at all clear what other effects would have resulted from a similar scaling up and down of other transactions affecting the same people. An example would have been an increase in capital costs due to the input of workers being revalued (see also 45). Whilst it is perfectly true that almost all projects do redistribute income to some extent the question is whether this requires some form of adjustment. To my mind the two classic cost benefit assumptions deal adequately with this case :

- that by and large the distribution of income in the community of optimal, i.e. there is no substantial body of political opinion in a position to act, that would substantially change existing income tax arrangements ;
- the effects of the decision on any individual are marginal. Although there can be a good deal of argument as to what marginal actually means in these terms, an interesting example was the case of householders affected by aircraft noise at the Roskill Commission. (36)

Most cost benefit analyses examine a single decision taken in isolation. This point is discussed later in the paper in the context of possible overall budget limits; however, at this point it is perhaps worth noting that a combination of measures all affecting the same group of people might very well have effects on them that were not marginal even if the individual decisions taken separately were.

One of the tangible benefits of the introduction of the cost benefit approach has been to underline the potential importance of compensation. This was probably the only successful aspect of the Roskill enquiry in the United Kingdom. It appears to have been a factor in the introduction of much more realistic compensation rules which provide *inter alia* for payment where no land is physically used but where noise diminishes the value of property. (14) Such internalising of costs also removes many of the problems of equity discussed in the previous paragraph; the polluter pays and the sufferer is properly compensated. However, such schemes can have adverse effects in that they create political pressure to deny the phenomenon concerned. In a slightly different field, acceptance in principle that regional cost of living differences should be recognised in salary payments has led to a widespread denial of the existence of such differences. Similarly the suggestion that people living in the country must be more sensitive to aircraft noise than those living in towns has been opposed on the grounds that this could lead to increase in the State's liability for noise insulation compensation.

Cost benefit analysis reasons in terms of money. Although this is simply a question of convenience, it has been interpreted as meaning that the analyst believes that only money counts, that he is a crude materially minded economist, etc. Although it undoubtedly "strains plausibility and common sense too far by seeking to place a money value on every item of cost or benefit", (26) there seems to me to be little case for searching for other units, e.g. thermodynamic potential (153) or time (10). Whether we like it or not, monetary units have a very deep rooted place in our system of political discussion, and to choose other units would be likely to reduce rather than increase the credibility of the method.

Finally, it has been suggested that the cost benefit approach is incompatible with democratic decisions. It "seems at best to lead to an elite controlled technocratic future". (64) Some analysts not only accept this elitism but try to make a virtue of it. "Inevitably the assessment (like the whole planning process for that matter) is elitist to a greater or lesser degree; however, no entirely populist system would cater for future generations either". (68) Politicians are sometimes said not really to be

interested in the values given by individuals but to prefer the views of experts. These criticisms confuse two things:

- the analysis as such. This will always be a more or less elitist activity in the sense that it relies on skills that are bound to be fairly rare ;
- the generation of data to be incorporated in the analysis. For me one of the great attractions of the cost benefit method is its firm basis in individual preferences, the use of revealed preference in the market wherever possible, and the careful design of methods to evaluate intangibles as they are perceived by the population (see Section H below).

It is revealing, however, to note that in a recent discussion in the United Kingdom on the use of market research methods to determine the wishes of the population a senior minister expressed the view that such methods "were not acceptable in a field of this kind in a democracy".

E. TECHNICAL LIMITATIONS

"We know that intellectual food is sometimes more easily digested if not taken in the most condensed form. It will be asked, to what extent can specialised notations be adopted with profit? To this question we reply: Only experience can tell". (7)

Two criteria seem particularly important when judging the theoretical framework in which cost benefit analysis is carried out:

- the extent to which the various assumptions made are based on a sound application of behavioural sciences ;
- the quality of the logic which is used to manipulate these assumptions into a usable welfare function.

Unfortunately "collective preference functions have had plenty of theoretical thought devoted to them and much less empirical work". (120) Such a preference for theory rather than observation has been the bane of the whole method but this failure to properly define and agree a framework of reasoning is at the root of many of the difficulties which analysts have found with decision-makers (and, much more important, vice-versa). "There is no need to labour the difficulties in defining quality of life"; (32) however, some such definition must be attempted and made explicit. It should come as no surprise that this quality "is clearly almost entirely a subjective matter". (32) The formulation of a welfare function must, therefore, allow for individual preference. One critic of the cost benefit approach contrasts it with methods in which "a rational autonomous self-interested individual [is] free to voice

his preferences directly both in market and in political arenas". (148) Unfortunately, this admirable intention, which for me is at the heart of our approach, can easily be distorted into what might be termed the referendum approach, in which all decisions would be submitted to, say, a public opinion poll. The defects of this latter idea, which in my experience seems very attractive to analysts of political decision taking, are discussed in Section I below.

A theoretical framework which I found particularly attractive is the one set out by Jacques Lesourne in his "Calcul Economique". (85) This seems to me so important that a rough summary of it is included as an appendix. The need for such a recapitulation may seem strange to those who believe that "the main conventions of this kind of calculation are established and well understood". (46) However, this has not been my experience; in one debate among fellow workers in the field almost every single point in Professor Lesourne's presentation was challenged with the utmost severity. (33)

A final point in this context is that the drawing up of a cost benefit framework demands certain assumptions. Without them the whole analysis becomes completely unmanageable and discussion of it impossible. However, such assumptions have their cost in the sense that they are bound to over-simplify reality. In many countries, we seem to have a long way to go before there is general agreement on the reasonableness and efficiency of any set of assumptions; until such agreement is reached many will continue to suggest that cost benefit seeks "to usurp the entire decision function of a political democracy by pretending to be looking for a way to square this circle". (126)

A particularly tempting form of assumption concerns the range of factors that are to be admissible in the utility or satisfaction of an individual. For example, in the evaluation of a speed limit on roads "should we revise the postulates of rational choice in order to be able to include love of danger under rational behaviour". (92) The answer to such a question can only be in terms of the practical merits of the case, i.e. would the inclusion of such a factor have any effect on the outcome of the evaluation. To exclude factors of this kind because the analyst considers them to be irrational or even reprehensible, would be elitism of a very dangerous kind. Of course this does not exclude the possibility that the analysis should include the driver's love of danger as a benefit on the one hand and the costs in terms of loss of life, etc., on the other.

The costs of CBA are usually small as a proportion of the decisions that they set out to analyse; however, they can still be considerable in the absolute and their application to a very wide range of alternatives prohibitively so. This has led to the

development of a variety of multi-criteria methods which achieve economy for two slightly different reasons:

- they do not attempt to express the whole evaluation in terms of a single monetary figure ;
- they can use surrogate criteria which in themselves sum up a range of facets of a more formal analysis. For example in an evaluation of airport sites, a criterion "number of airports in the system" might sum up a whole range of effects linked with ideas such as economy of scale, concentration versus decentralisation, etc. (95)

The use of such methods is very much to be welcomed. Indeed it is the only way to ensure that the final solution is the result of a thorough review of all reasonable alternatives. However, it should not be thought that they are in any sense in conflict with CBA; they both stem from closely similar views of the problem. Multi-criteria methods simply attempt to apply the spirit of the cost benefit approach to situations where a complete application would be unnecessarily expensive. (119, 93, 5)

A technical problem which receives extensive discussion in the literature is the relationship between the present and the future. A wide variety of methods has been suggested for approaching this with sometimes quite widely varying results. For example a rate of 10 per cent seems fairly general in the United Kingdom and France, 5 per cent in Germany and a preference for a range of rates in Holland. This is another area in which very elitist views are occasionally expressed, e.g. "the defect of telescopic faculty (Pigou) which makes individual preferences an inappropriate criterion for the evaluation of future needs". (47) Although individuals are likely to vary widely in their views of the future, there is no shortage of evidence on these views in terms of the way in which individuals behave when faced with investment and borrowing decisions of various kinds.

Both in industrial evaluations of the DCF variety and CBA, it has been suggested that different rates should be used when discounting different kinds of cash flows. However, this has two serious dangers:

- it can render the final result virtually incomprehensible in the sense that it builds in a wide variety of preferences peculiar to the analyst ;
- the procedure seems impossible to justify theoretically or, more important, to check.

For both these reasons, I feel that it is better to concentrate effort on the amount to be discounted rather than fiddling with the discount rate. (48)

A further practical problem is that transport investments are often not independent from one another. One obvious example is the construction of a canal such as the Rhine/Rhône or the Oelegen-Antwerp (6) in which the justification of individual stretches may be dependent on the completion or otherwise of a much larger scheme. In a slightly different field, similar problems have been discussed in the analysis of information. (27) This point was also taken up in a previous Round Table. (19) The problem is very common in industry and the theoretical answer is clear enough. This is that formal classifications of cost (e.g. direct and indirect) should be subjected to careful scrutiny, and that for a given year only those costs or benefits would be included which would be incurred if the investment went ahead and not otherwise. Unfortunately, in practice this may not be so easy; an important reason would be that we do not know which decisions will be taken on other interlocking investments. This has led to a search for methods of evaluating groups of investments simultaneously using mixed integer programming methods. However, surprisingly enough, very few of these seem to have led to practical applications. One reason given for this is that "unfortunately neither the politicians nor the administrators can give the exact data for the capital available". (133) Some interesting work has been done on this problem in France using an approach called CAPRI. (96)

A very important assumption in cost benefit work concerns the optimal management of organisations, both Governments and industry. In the case of businesses this states that for the vast majority of firms the net present value of receipts and payments will be zero (no producers surplus). For governments, the equivalent statement is that the last dollar spent brings a dollar's worth of value to the community. There are, however, important exceptions to this assumption, i.e.:

- organisations for which there are economies or diseconomies of scale. In practice the chief danger to the analyst is the widespread belief in such economies where in fact none exist;
- infant industries: this is really a special case of economies of scale;
- technical spin-off effects;
- organisations central to the decision being taken, e.g. the railway in the case of a railway investment. (49)

One of the great defect of the Roskill Commission (131) was that such exceptions were never formally recognised; indeed it was stated that the existence of sums which might be labelled profit, producers surplus, etc., was of no consequence to the

decision being taken. This is a crucial point; if it were to be accepted it would make a nonsense of virtually the entire existing economic structure.

The discussion up to now has concentrated on situations where forecasts are available for evaluation. However, such forecasts are almost always wrong and this raises a question of risk. Here two approaches are canvassed:

- sensitivity analysis setting out the results of various changes in forecasts and other assumptions about the future ;
- some form of probabilising of these calculations. (50, 94a).

Whilst the second method has considerable theoretical attractions, my own experience is that it is unworkable. The problem is not only that many decision-makers find considerable difficulty in attaching probabilities to their forecasts, but much more that the result is extremely difficult to understand. It is perhaps another case in which theoretical discussion has proved to be more attractive than empirical observation!

F. DEFINITION OF ALTERNATIVES

"Anyone who questions or even ventures to examine the fundamentals of accepted social beliefs is apt to be overwhelmed in a chorus of execration". Maurice Kendall. (72)

For the analyst the main problem is often to persuade the administrator or politician to suggest alternatives. This is often his own fault in the sense that he arrives too late in a process where the decision-maker has:

- examined the problem ;
- thought up a solution ;
- looked for a justification of this solution.

In such cases the most the analyst is likely to receive by way of an alternative is "do nothing". If this is clearly impossible, he may then be tempted to dream up his own alternative based on his often limited knowledge. The organisational aspects of this problem will be discussed in Section I; however, here I would like to emphasize the importance of creativity in defining alternative solutions to transport problems. "To bring about the kind of improvement which will assure urban mobility while preserving environmental quality, a vigorous and sustained level of innovation will be required". (114) Whilst there is no formula for creativity, two points seem particularly important:

- a very sceptical attitude towards statements that certain solutions are politically unfeasible. An example might be

the widespread belief that restriction of private cars would provoke automatic political hostility (108) whereas several surveys have shown that this is not so if such action is properly justified.

Political acceptability often has its price ;

- the analyst must keep his methods flexible at least in the early stages of the evaluation. If the reaction to a new suggestion is that "my model will not handle it", the decision-maker is often unlikely to object "as long as it proves my point", alternatively he may turn his back on the evaluation altogether.

An important aspect of flexibility is that the analyst should be available early enough in the process, i.e. before decisions have hardened. This is unfortunately an extremely complex organisational problem.

"The generation of alternative solutions to transport problems should not occur as something separate from the planning process as a whole". (94) In particular as "other alternatives are eliminated, new ones are added and the systems of goals and objectives is reformulated". (134) However, "there is no doubt that, in many cases, the project generation process occurs quite independently of project evaluation. It is in the nature of the practical planning situation that projects are often designed, sometimes in detail, long before financial resources become available to carry them out. Therefore, there may be little incentive at the time of project evaluation to generate alternatives to the proposals". (51) In practical terms this close inter-action can only be achieved if the analyst is part of the planning team.

It is sometimes possible to draw up a virtually exhaustive list of all the solutions to a transport problem. For example in the Central England Airport Study, a small number of relatively weak assumptions enabled a full listing of the 1,200 or so practical combinations of airport systems. (95) However, such completeness is exceptional; the process normally begins with a more or less arbitrary stage in which solutions are deemed to be admissible or not according to a number of very simple criteria, e.g.:

- technological feasibility ;
- fiscal feasibility ;
- necessities for regional or urban development ;
- quality of the environment ;
- quality of service.(135)

The practical decision to be made is not only whether an investment should be carried out or not; its timing is likely to be equally critical. In some problems, it may be possible to decompose

the problem into these two dimensions; however, in others, it is not, and timing is critical to whether the investment is justified overall.

Sometimes, an over-rigid interpretation of the analytical method has led to an unduly restricted shortlist and consequent accusation of arbitrariness. Equally, in cases where a long shortlist was considered but the report of this part of the procedure was inadequate, the impression can be gained that only the handful of solutions finally retained were ever considered at all. (160)

Occasionally, the whole procedure of shortlisting and final analysis can be covered by a formal optimisation routine similar to the methods employed to solve the distribution problem. (75) However, even where such optimisation presents a range of solutions rather than one single result, we feel that it is likely to be rare in view of the considerable uncertainty which typically surrounds transport problems.

A further approach, described by Zeleny (167), is multi-objective linear programming.

G. ANALYSIS OF SYSTEMS

Many investigations which have culminated in a cost benefit analysis have been criticised on the grounds that the system being analysed is inadequately understood. In other words there is very little point in applying a sophisticated method to data which is extremely poor. In the present state of the art, such criticism often carries considerable weight and where uncertainty is great it may be sensible to stop short of full evaluation in terms of a single criterion and limit analysis to multi-criteria methods. In any event, the starting point must be the collection of adequate data about the system under review, e.g. origin and destination statistics for the traffic to be forecast. (109) Such data cannot be produced overnight, and it is therefore encouraging to see such exercises as the European Inter-City Transport Study which is setting out to assemble such O & D data over a wide network in Europe. (118) Indeed one of the striking changes which have made cost benefit analysis possible in many areas of public decision is the dramatic improvement in the quality of data available.

Often, the most serious question to be asked is, however, about the validity of the forecasts which are based on the historical data. Much of these are still based on statistical methods of one kind or another; this assumes a high degree of continuity between the past and the future. "Instead of putting ever more effort into attempting to establish the nature of trends or relationships, predictionists would be better advised to look at

the circumstances in which trends break or relationships break down, with the aim of establishing that sudden changes of the trend break variety can themselves be predicted". (158) Such information will never be forthcoming as a result of purely mathematical analysis as "qualitative or technological forecasting requires visionary talents.... rather than the sheer projection of the pattern of the past". (88) Here, the most promising approach is the use of experts, but this requires a very carefully designed system of investigation if the element of subjectivity in the opinions of individuals is to be minimised and the maximum use made of their collective wisdom. (59)

A good deal of lip service has been paid to the idea of combining transportation studies with an investigation into their effects on land use. However, it is noticeable that in one of the few truly national transport plans that we have been able to trace, the distribution of population was assumed to be fixed whatever the transport system. (74)

A similar situation obtains when discussing industry and the consequences which this has on population. Almost all those who have studied industrial location conclude that "there is practically no factual knowledge", that "the effects produced by the infrastructure are in themselves slight" (20) that although "these considerations lead only to the conclusion that secondary effects may be very limited, one can list a considerable number of unsuccessful development road projects". (56) However, this has not prevented a widespread belief in the efficacy of transport investment as a method for encouraging industrial development in Europe, Such arguments have been deployed in promoting the Rhine/Rhône Canal, the Saar/Pfalz Canal (in which the canal was shown to be less good in cost benefit terms than a railway but was preferred on the grounds of political opinion regarding industrial location), and the arguments surrounding the construction of a possible Benelux Airport.

There is also considerable uncertainty on the reaction of firms and individuals to other aspects of transport schemes. As a result, serious forecasting errors were made on the likely share of containers when compared with such things as ro-ro. Equally, there is little sound information on the relative importance of frequency of service in airport planning, the likely reaction of individual or distribution organisations to traffic schemes, etc.

In the past, analysts have given the impression of concealing such uncertainty by elaborate model-building exercises. Here, we are not referring to the kind of technical model used to predict, say, noise contours, but rather those which interpret human behaviour. While such models represent an invaluable advance on earlier methods and greatly extend the investigators' understanding

of the problem, it now seems clear that there is an imbalance between the quality of the operational research employed and the value of the underlying data.

Such data can only be improved by a combination of careful observation of existing situations, and, where possible, new experimentation. (110) The history of such experiments is, however, discouraging. For example, the value of polarised headlights and windscreens could have been demonstrated once and for all if the Prince Edward Island scheme under Professor Kare Rumar had been carried out, whereas this appears to have been crushed in the administrative process (118b). Equally, when experiments have been commissioned, the approach to them can be distinctly negative, e.g. the reception of the Verona traffic pricing experiment. A typical reaction to proposals for such experiments, which has been quoted in several countries is:

- Who else has done it?
- Why should we be the first?
- We don't want to get caught out in the open.

This is not to say that no successful experiments have been carried out, but rather that these have been inadequate. Encouraging examples are the Strøget Scheme in Copenhagen, (111) the TRRL's experiment on "Italian" marking of roads in the United Kingdom, and the restriction of traffic in a number of city centres. However, the analysis of traffic systems is only likely to improve if imaginative pilot schemes are commissioned; in view of the expense involved, these need a strong lead from central Government and perhaps from super-national organisations, such as the EEC Commission. (106).

H. QUANTIFICATION OF INTANGIBLES

"It is quite true that contentment can be attained otherwise. We could aim at a condition such as existed in the Netherlands in some industrial regions in earlier times and which was described by cynics as follows. The priest kept the people ignorant and the manufacturer saw to it that they remained poor. Because they were ignorant they did not notice that they were poor and therefore remained content with the circumstances under which they had to live". (80)

As we have seen, there is nothing new in the idea that economic analysis should cover not only goods and services for which there are prices in the market system, but also so-called intangibles, for which there is no such price. However, the great achievement of cost benefit analysis has been to translate this theoretical promise into a practical, analytical tool. This has been

done by devising methods of attaching values to such intangibles, usually by finding situations in which people do pay for the intangible in question and so reveal their preferences.

A great deal has been made of the fact that such preferences are essentially subjective. "Attractive is a subjective, not objective term. A thing may be attractive to you, to me, to the Secretary of State for the Environment, but it cannot, all on its own, be simply attractive". (150) "There is a danger that the judgements expressed on environmental matters are personal and subjective, rather than determined by the properties of the object". (130) As we have seen, such a mistrust of subjective values seems to spring from an inferiority complex felt by social scientists when comparing their methods with those of the natural sciences. Most of economics is concerned with subjective effects, and there seems to be nothing wrong in that. The important thing is the realism with which the methods chosen evaluate subjective preferences and take into account the individual values of the people that are likely to be affected.

There is, however, a context in which the division between subjective and objective values becomes particularly important. An example of this is the effect of noise on the community; this can be analysed under a number of headings:

- Effects on health.
- Effects on task performance.
- Amenity or subjective reactions to noise. (24)

In this example, the first two effects are objective or scientific, whereas the third may well contain a substantial subjective element. In other words, the individual's view of noise may well contain elements other than fears for his health or feelings that his economic performance might suffer, e.g. the fact that he simply does not like a noisy environment. Much work on intangibles has been bedevilled by a confusion between these two classes of effect and a concentration on the former. In fact, the "objective" results of transport noise are likely to be negligible, whereas the subjective sufferings caused by them are almost certainly not. (63)

A second interesting example of this problem is the case in which the sufferer is also the employee of a company. "There is thus the unavoidable ambiguity as to whether one should attempt to assess the individual's or the organisation's willingness to pay" (28). Although there is probably some overlap between the two, it seems to me that these should be regarded as two separate and normally additive values. Two interesting examples may be taken from business travel situations:

- when an employer pays for an employee to travel first class rather than second, it is likely that this brings the former

very little direct benefit. However, the employee may well gain considerably ;

- when faced with the choice between travelling by air or by train, between London and Brussels, the employee may well be indifferent. However, the employer could show a marked preference for air as this will show him a resource saving on the employee's time.

An interesting aspect of such subjective values is that they can change over time in response to educational and other pressures. In this sense, we can hardly avoid the following question when discussing the methods of reducing the social impact of noise: would it be cheaper to reduce this impact by teaching people that noise is desirable rather than by attempting to reduce the noise? Some writers consider that "it need not strike most as oppressive if skillfully promoted as the only means to achieve the greater social good". (83) However, some might share the views in the report, *The Changing Image of Man*, which "mentions with horror some of the manipulative techniques (Goebbels)" that have been used (65). Even if this subject is considered somewhat distasteful, it cannot be avoided; it is perhaps regrettable that so little space seems to have been given to it in the literature.

Any evaluation of environmental or other intangible effects, must begin with a definition of units of impact. In transport studies, we are fortunate that such units are relatively well developed, i.e.:

- Units of time.
- Measures of noise such as NNI for aircraft, L10 for road traffic, etc.
- Descriptions of certain consequences of accidents.

However, even if difficulties of defining the units are less than in other fields, such as health and education, they still exist. We have already noted such things as the value attached to frequency of service of public transport, attitudes to danger, and so on.

Having decided on units of measurement, we then have to fix some kind of price per unit. "This determination of values is of course an empirical matter" (90) and a number of approaches have been suggested:

- "a. Analysis of the housing market.
- b. Analysis of amenity improving expenditure, e.g. double glazing.
- c. Gaming.
- d. Laboratory simulations.
- e. Social surveys". (25)

A further possible approach is to set up in-house experiments, such as the research on noise described below. (122) It is interesting to note that although measurement of house prices figured fairly prominently in the literature five years ago, this now seems to have been largely discredited. This seems to have been for two reasons:

- theoretical arguments indicating that effects such as the cost of noise are inextricably entangled with supply and demand factors. This means that any observations are virtually unanalysable ;
- the results of certain key studies such as the work at Keele University which showed that house prices in noisy locations actually went up. This presumably meant that the supply and demand balance was such that quiet houses only commanded a very small premium and this was more than off-set by locational or other advantages that happened to be associated with noise.

"One of the opportunities that systems analysis offers for creative work is seeking ways of giving valid measurements to things previously thought to be unmeasurable". (12) This is, I hope illustrated by the following examples. However, before going on to them, one further word of warning should be mentioned. "The real world is immeasurably complex and for what may appear to be an identical good or service, values may vary substantially between one set of circumstances and another. When we are attempting to infer values in non-market situations, the difficulties and expense of the appropriate research often force us to adopt a relatively simple and crude classification of goods or services investigated. Thus, it is difficult to ensure that valuations obtained in one context are fully applicable in others". (52)

As an example, it is extremely dangerous to extend values of time obtained in the commuting environment to other situations e.g. surface access to an airport. Equally, most measures of noise are in terms of the energy emitted; as has been noted by many observers, there is a considerable difference for some people between the noise of a symphony orchestra and that of an aircraft taking off, even if the energy level is the same.

A number of research projects have examined attitudes to road transport and shown the importance attached to both safety and noise. (155) Equally, work on noise in most of the EEC countries has shown that traffic and aircraft are the two most annoying sources for householders. (152) In view of this, it is perhaps surprising that so little serious work should have been carried out on the subject of noise evaluation. Most of the research effort appears to have been much more accoustical, or even medical, (154)

in content. This medical bias is also strange as "in the light of the noise levels caused by vehicles, there is no danger to people living near roads". (65)

Work designed to produce values has concentrated in four approaches:

- measuring house prices, as we have seen, this is largely discredited on theoretical grounds ;
- market research, often based on some form of game. The respondent is faced with a range of possible attributes of a house, with some form of price tag attached to each. He is then required to arrange the attributes to fit a given budget ;
- in-house experiments on noise, using a noise machine. The householder is faced with an actual bargain by which he is paid to have the noise in the house ; (122)
- the shadow project approach put forward by Professor Klaassen and others. (81) Here, "preventative costs were chosen since the current state of scientific development does not permit direct monetary quantification of the damage caused by traffic noise which affects man's level of satisfaction..." (162) The approach is therefore to evaluate the cost of removing the noise nuisance. Although attractive as a concept this obviously has fairly serious limitations if the question to be answered is precisely whether the noise should be removed or not. The argument here can easily become somewhat circular.

Safety has been shown to be the most important single factor in peoples attitudes towards traffic. Although a good deal of work has been done on this subject much of it seems somewhat theoretical in the sense that I have been able to trace little that is based on surveys covering a reasonable number of individuals. The three most attractive methods of evaluating loss of life seem to be:

- evaluation of the total cost of loss of life. Unfortunately this tends to be an extremely emotive business ;
- evaluation of reducing the risk of loss of life. This avoids the emotive danger and is perhaps the best direct approach ; (98)
- the shadow project approach referred to above. (82)

This is an interesting example of an intangible which contains both objective and subjective elements. The former include the economic costs of the accident and losses of production due to people being off work. The latter covers apprehension of risk and also the physical and mental suffering produced on those involved in accidents and their relatives and friends.

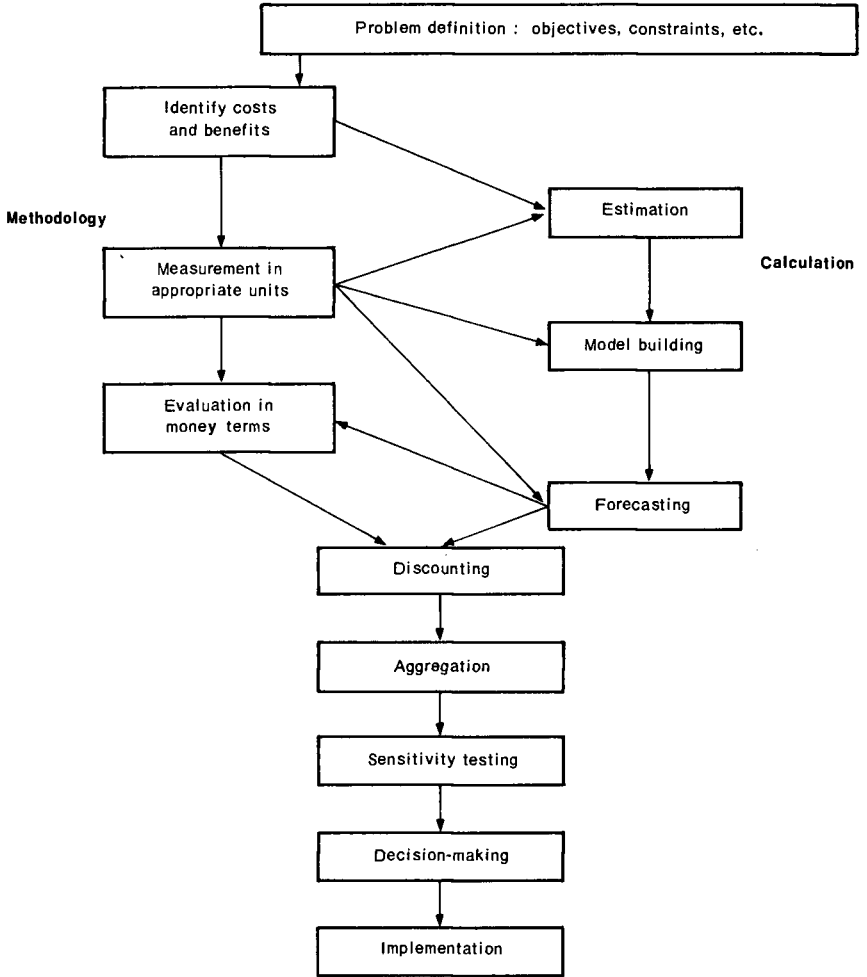
Of all intangibles time has probably had the most studies devoted to it. (2,3,57) These are extensively described in the literature. However, once again a research programme is required if we are to overcome the difficulties of extrapolating values from commuter situations to others. "The value of time savings is such an important component of the overall benefit of transport investments that the use of appropriate time values could have a substantial effect on the allocation of investment funds between projects.

We need therefore to be sure that the time values used in particular cases are derived from studies of broadly similar situations. This is not the case at present. Additionally we would like to see specific account being taken of improvements in other service qualities; the use of a hybrid value of time makes this difficult". (53)

An interesting point in the valuation of time is the belief that such values are not linear and in particular that small time savings are relatively worthless. (54) This is certainly not backed up by satisfactory evidence but seems to be based on the fact that given, say, 15 seconds nobody would be able to do very much with it. Whilst this might be true of a wind fall benefit of such a small amount on specific occasion, the traveller is not aware of the fact that he has saved 15 seconds or any other amount of time as a result of the transport scheme. By definition the alternative has not come about, and the savings therefore become incorporated into the natural order of things, to be added to or subtracted from the various other components of time in a person's life. This being so, any assumption of non-linearity one way or the other seems particularly suspect on theoretical grounds.

In some countries the values of time have been imposed for use in transport evaluation, e.g. those in the *Rechtlinie für Wirtschaftlichkeit für Strassenbau* in Germany. Work on other intangibles is very thin. There is an interesting discussion of the evaluation of an area of natural resource in the analysis of the Oelegem (6, see also 89) Canal and an attempt was made to value comfort in the work on the Victoria Line in London. (31) Furthermore, there are interesting discussions on the evaluation of esthetic considerations in the 18th Round Table (23) and of consumer surplus connected with housing in a paper by Flowerdew & Rodriguez. (30) This is of course not an exhaustive list but it does to my mind indicate an urgent need for much more convincing research if many of these factors are to be taken seriously. (55)

Table 1



COST/BENEFIT METHODOLOGY

I. THE POLITICAL PROCESS

"I also asked that you insist that your staff consider the issues objectively free from what they think may be overriding political obstacles to constructive change. I want to pass judgement personally on such alleged political obstacles".

Lyndon B. Johnson (129)

The chart in Table 1 shows the steps in the evaluation of a transport decision that were proposed by the 9th Round Table in 1970. It is perhaps significant of the confidence of analysts at that time that the stage of selling the analysis to politicians should not have been mentioned (and also that there should be no reference to the generation of alternatives!). Things have changed a good deal since, and the intervening five years have taught us to be much more sober in our expectations. This relative pessimism has arisen partly because analysts oversold their goods when cost benefit first came to prominence, but also because politicians and administrators have shown themselves to be fairly resistant to change, particularly on matters which they considered to be of political importance. "Responsibility then, is the missing link between theory and action. To bring theory to practice the administrator must be willing to commit himself to bring in new values into a situation". (164) "It would be ironic if... efforts to introduce PPBS taught social scientists more about the needs of politicians than it taught politicians about the needs of society". (166)

It is impossible to devise a neat formula which sums up relationships between analysts and politicians. These are extremely complex and very much dependant on national and even local circumstances. However, in my discussions around Europe I have been struck by three major complaints on the part of the analysts:

- that the decision has already been taken and that analysis is merely asked for as an additional political weapon to be used if it produces the right results. As an example this view was expressed to me about the 130 km speed limit experiment in Germany ;
- the need for overhaul of parliament and in particular the introduction of more numerate parliamentarians. Typical quotes were "politicians in France are very poorly informed on things of this kind", "our members of parliament are all lawyers". etc.;
- the very short term cycle engendered by most parliamentary systems. "Permanent under Secretaries and Ministers are in office for such a short time that they can never master any job". "Rational assessment of decisions is very difficult

in a democracy as others stand to gain". Two examples of political decisions in the United Kingdom were quoted to show the length to which political perversity might go.

	Summer Time	Roskill
Enquiry initiated by	Conservative	Labour
Decision to reject enquiry		
results taken by	Labour	Conservative

Whilst most analysts would welcome the spirit of the Lyndon Johnson quotation at the head of this section few would be brave or foolhardy enough to take him at his word in all circumstances. However, the introduction of political factors in the course of an evaluation, calls for very careful presentation. In one study (95) this took the form of a primary recommendation which the writers of the report recognised to be politically unacceptable (in their view for wrong reasons) and then went on to produce a second best solution. However, because this effectively meant doing some of the work twice (the short list was not designed to contain the second best solution) it resulted in a fairly substantial increase in the overall study budget, say 15 per cent.

I don't think that it is cynical or improper to suggest that politicians are most concerned with getting re-elected. This means that they are extremely sensitive to public opinion and this raises two interesting issues for the analyst:

- determining what public opinion is. Politicians are not always well informed on this point particularly when the opinion in question concerns technical issues of which they have little experience. An example has already been quoted of views relating to restriction of car use. In some circumstances it is therefore appropriate for studies to cover an examination of public opinion either formally or informally ;
- the way in which public opinion is informed. In most transport investments there are groups of people who stand to gain or lose from the various solutions. Many of these are not obvious at first sight. Such groups, particularly corporations, will indulge in effective public relations to ensure that the case for the solution which they favour (or against the one which they reject) is put before the public. "However, the loudest voice is not necessarily the most important and by no means necessarily the best informed. Evaluation techniques should be designed to help everyone understand better the issues that have to be settled". (37)

In practice this means a mixture of consultation, careful presentation to interested parties, deliberate searching out

of objectors and explanation of the case to them. A study in which these methods were apparently very successful is the plan 2000 recently carried out in the Netherlands; in this a wide Steering Committee was used as an essential part of the consultation process. However, Professor Klaassen and his colleagues also spent a good deal of time arguing the conclusions of their study with the various academics, pressure groups and so on who might otherwise have influenced public opinion in an uninformed way.

Public opinion should therefore not be regarded as a danger to cost benefit analysis but rather as a factor which needs to be taken into account. In practice this can mean that at least a third of any study budget can be spent on consultation and other forms of PR activity. It often greatly reduces opposition if the true facts of the case can be carefully put forward to all concerned and costs reduced in the long run. "Science has made it difficult for many people to rationalise prejudice". (41)

We saw that analysis can only be effective if it is brought to bear at the right points in the decision process. This calls not only for considerable resources but also for a suitable position for the analyst in the various public sector organisations taking decisions on transport policy. Furthermore analysis is not a one way process. If widespread disillusionment and cynicism is not to result at the lower level, of, say a Ministry, decisions on projects that come up through it must be expressed in a framework of reference which enables improvement of future decisions. "Since a political specification can be given to only a small proportion of choices at the highest level, and at lower points in the hierarchy real choices must be made consistently with the preferences expressed politically, a mechanism must be found either to ensure the consistency of judgments made at the different point of the system or to provide valuations derived from the overall political decisions which can be used as (inputs) to the decisions of a lower level official". (22)

"(The analyst) must so engage the confidence of the departmental personnel so as to become intimately aware of their thinking on potential superior alternatives". (66) The same could be said for the reverse process and the method "needs a continuous objectification by means of continuous confrontation with decision-makers". (101) The planners' place in an organisation must therefore take into account two important factors:

- the need for realistic resources ;
- an appropriate relationship between planners and decision-makers.

If these conditions are not achieved, then "(planning) will probably become a ritual and probably an empty one at that". (8)

Such a close relationship between the analyst and his client, can, however, be dangerous in some cases and a certain leavening from outside analysts can be felt desirable. "Policy is to some extent necessarily a function of the administrative structure in which it is conceived and executed". There are times when it is good to move out of this structure, particularly if really far reaching and fundamental policy changes are being considered. However, there are clear disadvantages in studies actually being commissioned by interested parties as these can only too easily be dismissed as special pleading. (62) "It is when the full complexity of the planning process is contemplated that the value of specialised agencies becomes apparent. For planning in terms of the whole range of Government policy requires a perspective that harassed operating officials - frequently subject matter specialists - do not necessarily possess". (67) What is required is a relationship between the commissioning department and the outside research team which comes as close as possible to matching the spirit of L. Johnson's statement.

Finally, cost benefit methods will only be used by politicians and administrators if they are properly explained to them and if they have a chance to influence the way in which the analysis is carried out. Various teaching packages have been put together based on the experience of practitioners in studies and some of these are referred to in the bibliography. (15)

J. CONCLUSIONS

"Where providence was not available to correct mistakes of men, it was all the more necessary to prevent such mistakes". (104)

Cost benefit analysis has a long history; however, to all intents and purposes, it was introduced into Europe in the mid-sixties. At that time, great hopes were pinned on it by the small band of analysts who developed the techniques to the point where they could be applied to transport studies. It is difficult to maintain that subsequent development has lived up to this promise. One reason may be that the proponents of the method were too keen to attract the kind of innovators who would be enthusiastic for any new approach (and equally likely to drop it) rather than concentrating on the solid middle ground of intelligent administrators and politicians. (165)

It was certainly an error to assume that "nothing but benefit can come from making conduct self-conscious". (105) Many creative planners and politicians saw this as a threat to the whole method of working and expressed fears of some form of dull grey uniformity as a result of the economist's ministrations.

Furthermore, within the EEC there seems to be a general mood of scepticism "no course in life is without its difficulties and therefore we are very sceptical of almost any proposed method of analysis or what you will". Many of the practitioners with whom I have spoken feel that little progress has been made since 1963 and would find that there was distinct understatement in saying that "a final theoretically convincing solution to the problem of evaluation has not been found". (139) Most of the difficulties seem to stem from lack of research on two levels:

- basic research on the evaluation of intangibles "the human factors involved in the design and construction and use of roads and urban areas". (115) and on obtaining a reasonable degree of consensus on the framework to be used in analysis ;
- practical use of methods with a view to obtaining the necessary interface with politicians and other decision-makers.

There have also been failures in analysis. Equally analysts have sometimes not been particularly sensitive to the needs of politicians. For example in the case of the Rhine/Main/Donau canal the cost benefit analysis indicated that the project should not go ahead; politicians felt that it should, because of the industrial development benefits that it would bring. Serious work on such industrial development has, however, been particularly slender.

Obviously no analyst can guarantee the success of this work particularly in the present state of the art. One is therefore caught between two dangers:

- if too much emphasis is placed on the uncertainties and possible shortcomings of the analysis these will be jumped upon by opponents of its conclusions ;
- if a final report is written to give as much weight as possible to the conclusions that have been reached the reputation of both the analyst and the method can suffer, with resulting "disappointment in the report and even anger at it". (9)

Often this dilemma can be solved by the production of a variety of reports and presentations suitable for the various levels in the decision-making process.

A report such as this which calls for additional research is bound to provoke questions on the motives of its author and those authorities that he has quoted. A recent paper on impact analysis noted that "the consultants present might be presumed to have had a vested interest in such a system". (69)

In several countries the rise of economists and methods such as PPBS have provoked the same kind of reaction as the importance given to accountants and business analysts in larger firms. Such reactions cannot be overcome by theoretical exposition but only by analysts

showing that they have the interest of their client generally at heart and they are concerned by the problems which he faces.

A very tempting way of improving analytical techniques is to analyse past decisions. (29) A structure for doing this is apparently now being set up in Germany. However, such post-mortems have considerable limitations not least because the alternatives considered but not chosen have by definition not come about. Forecasts and other information relating to them are therefore not available.

We have also underlined the need for demonstration projects such as the planned Prince Edward Island experiment but we will need to encourage such experiments rather than greeting them with automatic scepticism.

I am again struck by the enormous gap between the complexity of the problems to be analysed and the present state of the art. Even if this gap is smaller for transport problems than in other areas of public policy it is still extremely disturbing. However, I feel that faced with this fact there are only two possible courses of action open to administrators and politicians :

- to recognise the impossibility of informed intervention in the market system and adopt a far more laissez faire approach to public policy. However, it seems unlikely that even faced with such a recognition a politician "will refrain from undertaking reforms of such complexity and consequence that they will make it impossible for him to sort out the causes and effects and to know what he is actually doing"; (140)
- to encourage the creation of tools capable of helping to choose answers which are at least as good from the point of view of the community as those produced by the market system.

Among these methods the cost benefit approach and methods deriving from it seem by far the most promising yet. Perhaps "it would be hopeless to try to erect a theoretical structure, which is logically, perhaps even aesthetically, on a plane with our idealistic image of an exact theory. Yet, if we consider the situation, not from the standpoint of the wishful dreamer of neat and tidy theoretical constructions but from that of a pragmatist in pursuit of a better understanding of the world through reasoned methods of explanation and prediction, then we have good reason to take heart... and we should realise that the seemingly thin line between vagueness and vacuity is solid enough to distinguish fact from fiction reasonably well in practical applications". (60)

If we do not make this attempt to develop cost benefit methods we will "have a welfare state but we do not know how to measure welfare. We have monopolistic industries which are supposed to effect economies of scale but do not know to measure their efficiency.... Furthermore, we have now not one social objective but a whole range of objectives and they frequently conflict". (73)

APPENDIX *

TECHNICAL DESCRIPTION OF COST BENEFIT ANALYSIS

COLLECTIVE UTILITY

This appendix sets out the broad lines of the theoretical justification for the approach adopted in the body of Chapter 2. The starting point of the analysis is summed up in two points.

1. The satisfaction of an individual is linked to a variety of factors, many of which can be referred to as the consumption of goods and services. These latter are defined in a wide enough way to include time, amenity, noise etc, and usually labour.
2. The common good or welfare of any group is determined by the satisfaction of its individual members - collective utility.

If q_i^k are the quantities q of goods and services i and the index k denotes people, these two statements can be written:

$$S_k = S_k(q_i^k)$$

(satisfaction is a function of consumption)

$$U = U(S_k)$$

(collective utility is a function of individual satisfactions).

CHANGE

Very small changes in the economy which affect only one period, for example, a year, will be looked at first. It is, of course, possible to cut up time in any way that is convenient; nevertheless, for our purposes, we generally find that the 12 months' period is the most useful. The change in collective utility is made up of the differences in individual satisfactions multiplied by the value placed by the community on each individual:

$$dU = \sum_k \frac{\partial U}{\partial S_k} dS_k$$

We can also write this:

$$dU = \sum_k U_k dS_k \quad U_k = \frac{\partial U}{\partial S_k}$$

* From M. J. FROST : "How to Use Cost Benefit Analysis in Project Appraisal". Gower Press, 2nd Edition 1975

Prices must now be introduced. In most cases, it is reasonable to assume that there is a single price system for all individuals and that the latter maximise their satisfactions taking into account their revenue r_k and the prices p_i that is: $S_k(q_i^k)$ is a maximum under the income constraint:

$$\sum_i p_i q_i^k = r_k$$

thus
$$S_{ki} = \frac{\partial S_k}{\partial r_k} \left(p_i + q_i \frac{\partial p_i}{\partial q_i^k} \right)$$

If it is further assumed that the unit price of any good is independent of the quantity consumed by an individual, one can write:

$$S_{ki} = \frac{\partial S_k}{\partial r_k} p_i \left(S_{ki} = \frac{\partial S_k}{\partial q_i} \right)$$

These assumptions are reasonable in the vast majority of cases. However, when this is not so, a correction factor can usually be introduced.

This is simply to state in mathematical terms that the marginal increase in satisfaction derived from the consumption of an extra unit of good i is proportional to its costs. $\frac{\partial S_k}{\partial r_k}$ is the additional satisfaction that we give to individual k if we increase his income by one unit. The following can now be written:

$$\begin{aligned} dU &= \sum_k U_k dS_k \\ &= \sum_{ki} U_k S_{ki} dq_i^k \\ &= \sum_{ki} U_k \frac{\partial S_k}{\partial r_k} p_i dq_i^k \end{aligned}$$

This means that the change in collective utility is equal to the change in consumption of individuals, measured at the original price, multiplied by a weighting factor.

$$U_k \frac{\partial S_k}{\partial r_k}$$

However, some changes in consumption have no effect on satisfaction. An example is given when a new bypass enables savings in petrol for a given journey. Such goods will be denoted by q_i .

One of the most important theoretical assumptions must now be made. This concerns the optimal distribution of income. It can be stated as follows.

The state has no preference between giving a unit increase of income to one individual rather than to another. As U_k is the value to the community of a unit increase in satisfaction for k and $\frac{\partial S_k}{\partial r_k}$ is

the increase in satisfaction of the individual k when he receives an additional unit of income, this assumption means that $U_k \frac{\partial S_k}{\partial r_k}$ is constant for all k. This constant can be made one by transforming the collective utility function. Thus comes the following basic result:

$$dU = \sum_{ki} p_i dq_i^k$$

This means that the change in collective utility in such a marginal movement in the economy is equal to the change in individual consumption evaluated at constant prices. (Excluding those items q_i which are forced on the consumer; we can call this consumption which brings no satisfaction.) It should be noted at this point that we do not need to take into account a term $\sum_k q_i^k dp_i$. This is because it has been possible to assume that no individual can affect prices.

BUSINESSES

The term that we have just derived is in fact not much use as it stands, because clearly we cannot measure all the individual consumptions. Therefore, it is often useful to transform part of the expression into terms relating to the profits of businesses. (In this connection, the definition of a business is a very wide one and refers to all economic agents other than individuals, for example, conventional companies, the state, and so on.) The following statement is now used, relating supply and demand.

$$\sum_k q_i^k = q_i = \sum_h q_{ih} + q_{io}$$

In this expression the q_{ih} are the quantities of i associated with business h: it states that the total consumption by individuals is equal to the total amounts associated with businesses making and using it, plus any external resources (say, imports). "Economic goods" refers to those that enter into the accounts of some sort of business. In a change therefore:

$$p_i dq_i = \sum_h p_i dq_{ih} + p_i dq_{io}$$

for one product and

$$\sum_{ki} p_i dq_i^k + \sum_{ki} p_i dq_i^k = \sum_{hi} p_i dq_{ih} + \sum_i p_i dq_o$$

for all normal economic products and all individuals.

Notice that i here only covers consumer goods. However, all other transactions between companies clearly cancel out over the economy as a whole, and the only further change we need take into account is that concerning movements in the use of outside resources for example, relating to unemployed labour. Now $\sum_{hi} p_i dq_{ih}$ is the

profit of business h defined in cash terms, that is, excluding such notions as capitalisation of fixed assets and depreciation, and is calculated at the price in force before the change. Thus:

Change in consumption of consumer goods by individuals	=	Change in profits of all businesses	+	Change in use of out- side resources (imports, exports, etc) or under utilised resources (for example, unemployed labour)
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Now, in the expression for the change in collective utility, there was the consumption of economic goods referred to above, plus movements in socio-economic ones such as time, less consumption of "no-satisfaction" goods q_i . The following statement is then obtained.

In a marginal change, with the various assumptions we have indicated and notably a single price system and optimal distribution of income, the change in value to the community is as follows.

1. Change in profit of all companies evaluated at constant prices.
2. The change in consumption that brings no satisfaction.
3. Change in use of outside resources.
4. Change in consumption of socio-economic goods by individuals.

On page 11 we look at the case of two price systems corresponding to a difference in the cost of living.

The discussion on page 12 adds rather more details on consumption which does not affect the satisfaction of individuals. However, we are left with two important theoretical points.

- (a) When is a change marginal, and what is the effect on the theory if it is not?
- (b) How can we take into account more than one period?

MARGINAL STRUCTURAL

The treatment of this case, which is common to many branches of science, is to consider the structural change as a series of marginal ones and to make assumptions similar to those put forward above for each of the steps. This has led to an expression for the change in collective utility:

$$U(2) - U(1) = \int_1^2 \sum_i p_i dq_i$$

If the demand curve linking price and quantity consumed is a straight line, this expression can be simplified to:

$$\sum_i \frac{p_i(1) + p_i(0)}{2} (q_i(1) - q_i(0))$$

The difference here is that we would have to consider not only the change in volume looked at in our marginal section, but also a price effect. The decision whether a change is marginal or not depends not only upon the absolute sums involved but also upon the effect on the different economic agents. Thus the changing of the site of a bridge might cost many millions of pounds but still have only a marginal effect on travellers or people living on both sides of the river.

TIME

Calculations such as the one just described can be carried out period by period giving a series of changes in collective utility. The question is now to bring these together into one figure. The solution depends upon the introduction of a notion of equivalence between periods from the point of view of the community. Once it is accepted that £1 today is worth more than £1 tomorrow an assumption that is clearly borne out by public investment programmes, one can write:

$$V(1) = (1 + p) V(0)$$

Where $V(1)$ is the value of £1 at the end of 1 year and $V(0)$ the value at the beginning of the year. This leads to the normal relationship for dealing with the discounting of cash flows:

$$V(r) = (1 + p)^r V(0)$$

$$\text{or } V(0) = \frac{V(r)}{(1 + p)^r}$$

Where $V(r)$ is the value of £1 after r years.

TWO PRICE LEVELS

Consider a situation in which two towns have different price levels $p_1(1)$ and $p_1(2)$. Suppose an individual moves from one to the other. His satisfaction will change as the income constraint will force a movement in his total consumption of:

$$\sum_i q_i^k (p_i(1) - p_i(2))$$

(One of the q_i may well be labour and this does not therefore imply that his income is constant.)

In order to restore him (and the collective utility) to his previous level, one would have to give him an additional income of:

$$\sum_i q_i^k (p_i(2) - p_i(1))$$

This means that in the term for the change in collective utility a correction should be added expressing the change in the cost of

living evaluated at the original levels of consumption of individuals who move multiplied by the difference between the two levels of prices before the change.

A similar term can be introduced relating to socio-economic goods. If an individual is obliged to move to a more noisy area, all things being equal, the country suffers a loss because of his reduction in satisfaction. This needs to be deducted when calculating the overall effect of the change.

CONSUMPTION THAT DOES NOT AFFECT SATISFACTION

The following is the case of a new road that allows an individual to save consumption of petrol for his private car.

Assuming that the total traffic on the route stays constant the fact of saving petrol will not affect anyone's satisfaction directly. This introduces a "bonus" into the system equivalent to the saving in petrol; this is of course spent on other goods which confer satisfaction equivalent to the value of the petrol saved. However, the point here is that contrary to the normal situation, this is not offset by a similar loss corresponding to a reduction in consumption. This arises because the service consumed is a journey and not a gallon of petrol.

Another way of looking at this would be to separate the role of an individual as a consumer from that as a transporter in his own private car. As the journey is unaffected, he has no change in satisfaction. However, his car business makes a profit equivalent to the saving in petrol and this will appear in the collective utility.

A similar case arises when looking at removal expenses forced on a consumer by, for example, slum clearance. If the employer recognises this cost, a corresponding term will appear in the collective utility as a loss of profit. However, if not, we must introduce a correction factor. Of course this case does not apply to moves which are made by individuals for their own satisfaction, to live in a more attractive neighbourhood, for example. Here the expense is part of the cost of an improved housing service.

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TECHNICAL ANNEX

Some examples of cost-benefit and multi-criteria analyses

Annex by A. RATHERY, (*) ECMT Administrator

The purpose of this note, which was written at the request of the Round Table participants, is to give some examples of practical applications of the analytical techniques on which the Round Table 36 discussions centred. It is intended, in particular, to give a better idea of the relationship between multi-criteria analysis and cost-benefit analysis and to present various multi-criteria methodologies, since these are of many different kinds (e.g. disaggregated approaches, aggregated approaches with weighting, aggregated approaches without weighting, mixed approaches).

Four examples have been selected, mainly with an eye to what can be learnt from them.

1. STUDY OF THE LYONS AND MARSEILLES UNDERGROUND (METRO) PROJECTS

The following study makes extensive use of X. Godard's thesis(1) and of the report of the sub-group chaired by M. Bideau.(2)

The approach is an extremely simple, disaggregated one but it does have the advantage of showing clearly where multi-criteria analysis stands in relation to cost-benefit analysis. As in any disaggregated approach, the different goals (solutions) are valued according to several criteria simultaneously; in some cases partial aggregations are made but no attempt is made to aggregate these partial aggregations fully into a single valuation. The final aggregation

*) As this Annex was produced after the Round Table meeting, it has not been submitted to participants or to Mr. Frost for appraisal. The author alone decided on its contents. The examples selected and the way they are presented do not necessarily reflect the views of the ECMT, still less can they be regarded as any commitment on the part of that organisation.

- 1) X. Godard: "L'analyse multicritère dans le calcul économique. Application au cas des transports urbains". IRT, Paris 1973.
- 2) Groupe de travail sur les études relatives à la construction à Lyon d'un nouveau mode de transport urbain en site propre. Rapport du sous-groupe 1: études techniques et économiques. June 1970.

corresponding to the decision is left to the decision-maker, who does it using some informal procedure.

Three aspects of the study on underground transport systems for Lyons and Marseilles will be considered more specifically:

- the formulation of variants as alternatives to the underground project;
- valuation of each variant by reference to many criteria;
- comprehensive appraisal by reference to selected summary criteria.

a) Formulation of variants

The aim here is to cover the widest possible range of feasible solutions, but as this ambition is limited by time and resource constraints there can be no exhaustive appraisal of every variant, hence the importance of selecting those that are most representative.

The variants were formulated on the basis of two criteria:

- satisfying demand under acceptable conditions;
- feasibility (technical and political) of the projects given the time allowed for their completion.

Five basic variants were chosen, each of them being assumed to be optimal (e.g. as regards the alignment) for the type of solution it represents:

- priority to surface transport;
- urban motorways;
- bus tunnel;
- underground;
- "minitube".

The next step after the formulation of these variants was a study of transport demand, i.e. both of overall demand and of modal split for each variant.

b) Multi-criteria valuation of variants

After due consultations several criteria were selected; they fall into five categories:

- transport conditions
 - . Transport time (door-to-door time, regularity and degree of confidence in time of arrival).
 - . Direct catchment area for own-track public transport (population, jobs).
 - . Comfort (seats, amenity, number of interchanges, public image).
 - . Safety.

- Costs
 - . Capital costs.
 - . Operating costs.
- Town planning and urban life
 - . Accessibility of town centre.
 - . Freedom of modal choice.
 - . Intrusion of the transport system into urban life.
 - . Miscellaneous constraints connected with building the infrastructures (how long the work takes, inconvenience).
- Links with the intercity transport system
 - . Link-up with the rail network.
 - . Link-up with the road network.
- Uncertainties
 - . Technological feasibility.
 - . Adaptability to long-term travel needs.
 - . Sociological constraints (resistance of certain social groups).

The values of all quantitative indices were computed for each variant. For the other indices, it was considered sufficient to rank the variants on a 5-point qualitative scale denoted by the letters A, B, C, D and E (A designating the highest score and E the lowest).

However, value judgements geared to real standards were gradually introduced so that the ratings were given a normative meaning (A = good, B = fair, etc.) and some of them were not allocated in partial valuations.

Tables were then drawn up to show how the variants (i.e. "solutions") scored under different criteria. Instances for essentially qualitative criteria are shown below. They were taken from the study on the Marseilles underground.

c) Partial aggregation and comprehensive appraisal

The information obtained by multi-criteria valuation of each variant was so highly disaggregated as to make it unwieldy for decision-making purposes, particularly in view of the large number of criteria taken into account.

In order to be able to compare the variants more concisely, the earlier valuations were accordingly re-grouped by reference to aggregated criteria.

One of these aggregated criteria, discounted cash flow, i.e. the outcome of conventional cost-benefit analysis, is quantifiable and therefore stands in a distinct category. However, where dcf figures are provided they are regarded as giving only some information on the profitability of each variant from the community

STANDARDS OF COMFORT ON PUBLIC PASSENGER TRANSPORT SERVICES

	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
% of seated passengers at peak hours	25-35%	25-35%	35%	35-50%	80-100%
Amenity (apart from the other comfort criteria)	B	B	D	B	?
% of users of own-track public transport using O interchange in 1975	-	-	60%	40%	
Quality of interchange facilities and waiting conditions	D	D	D	B	B
Public image of the transport system	E	B	C	A	B

INTRUSION OF THE TRANSPORT SYSTEM INTO URBAN LIFE

	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
Land area needed for new infra-structures	-	45 ha	-	-	-
Number of dwellings and activities expropriated	-	2 400	-	-	-
Visual intrusion	-	C	C	B	B
Barrier effects	B	D	B	A	A
Noise and vibration	D	D	C	B	B
Air pollution	D	E	A	A	A
Facilities for pedestrian traffic	E	E	B	A	A

standpoint. The case for choosing a disaggregated multi-criteria approach is still very strong; the information is aggregated but no attempt is made to choose between the various options, since this lies with the decision-makers themselves.

i) Discounted cash flow calculations for each variant

The following items were judged to be quantifiable in terms of money:

- capital costs;
- operating costs;
- safety costs;
- time savings;
- gains in comfort (inconvenience of interchanges and waiting).

The money equivalents of some items were based on largely conventional assumptions, i.e.:

- loss of life: Frs.230,000
- injury: Frs.1,000
- value to time: Frs.5 per hour for all users
- hardship coefficient for terminal times
 - . bus: 1.8
 - . underground: 1.3

The underground solution was taken to be the reference solution, so it was sufficient to calculate cost-benefit differentials.

For the Marseilles underground, for example, the following table of discounted cash flows was drawn up, the discount rate being taken as 10 per cent and costs expressed in 1970 francs at constant prices.

1970 Francs million	Solution 1	Solution 2	Solution 3	Solution 4
Discounted capital costs, net of tax(1)	523 + x	1 309	653	696
Discounted capital costs of the reference solution less discounted capital costs of solution 4(2)	-173 + x	+613	-43	0
Advantages of solution 4 over the solution under consideration(3)	(Gains in time and comfort) +33 (Savings in operating costs) +87 (Gains in safety) +8	-114 +151 +48	+56 0 +8	0 0 0
Discounted cost-benefit cash flow for solution 4 as compared with the solution under consideration [(2) + (3)]	-45 + x	+698	+21	0

ii) Partial re-grouping of qualitative criteria

The qualitative criteria were re-grouped on a highly empirical basis under broader headings and the variants (i.e. "solutions" were rated on a very simplified scale: "good", "indifferent", or "poor", but no attempt was made to aggregate all the criteria into a single yardstick as each of them would have had to be weighted and this is a matter of political choice.

iii) Comprehensive appraisal

The final appraisal for Marseilles is shown in the following summary table.

		Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
Criteria incorporated in discounted cash flow	{ Capital costs (Frs. million)	1 470	3 379	1 438	1 320	Lower than costs of solution 4
	{ Discounted capital costs, net of tax (Frs. million)	523	1 309	653	696	"
	{ General transport conditions	As defined does not fully match requirements concerning transport services to city centre	*	*	*	*
	{ Discounted cash flow for solution 4 compared with the other solutions (Frs. million)		+ 698	+ 21	0	?
Transport conditions of captive users Freedom of modal choice		-	△	*	*	*
Accessibility to city centre and reserves of accessibility beyond 1986		-	-	*	*	* ?
Impact on the environment		-	△	-	-	-
Uncertainties		△	-	△	-	△
<p>* Good</p> <p>- Indifferent</p> <p>△ Poor</p>						

2. CONSTRUCTION OF A NEW AIRPORT AT COPENHAGEN

By way of illustration, the following table shows the final appraisal of the advantages and disadvantages of the alternative sites considered. This table is taken from a paper by Mr. Kai LEMBERG in "Airports and the Environment"(1) published by the OECD. next page.

3. CHOICE OF ALIGNMENT FOR A MOTORWAY

This example, taken from Mr. M.J. FROST's "How to use cost-benefit analysis in project appraisal"(2) is selected to show how the analysis can be scaled down to reasonably modest proportions by following a sequential procedure.

It concerns the application of multi-criteria analysis to the choice of alignment for a motorway in the suburbs of a large city. A classic cost-benefit exercise was not feasible because one of the major differences between the projects was their relative effects on areas of park-like forest; these were at the centre of the problem, and no satisfactory method could be found of expressing them in monetary terms.

The procedure adopted was to make maximum use of the information available and then compare the projects two at a time. This led to statements such as the following:

A is definitely better than B and this relationship is accepted by all concerned.

A is probably better than B.

A could be better than B.

A and B cannot be compared.

These statements can be thought of in terms of a range of values for each of the criteria.

If at the outcome of the multi-criteria exercise the conclusion is that A is definitely better than B, this means that such a comparison would be true taking into account the extreme values of all such ranges for the different criteria. The statement that A is probably better than B means that A is better than B for the vast majority of the ranges of values, and so on.

In the case under review, the first three solutions involved a large amount of damage to forest and other areas of natural beauty; the three alternatives varied as to their precise alignment and also as to the possibility of putting some parts of the motorway underground. The next two alternatives (four and five) involved a somewhat longer journey, a very much worse effect on the general town

1) K. LEMBERG: "Finding sites for major airports: the experience of Copenhagen" in "Airports and the Environment", OECD, Paris 1975.

2) Michael J. FROST: "How to use cost-benefit analysis in project appraisal". Chapter 12. Gower Press, 2nd edition, 1975.

RELATIVE ADVANTAGES AND DISADVANTAGES OF ALTERNATIVE INTERNATIONAL AIRPORT SITES IN THE COPENHAGEN REGION

(The most important aspects are underlined)	Kastrup expanded	South Amager (+ Kastrup)	Kastrup restricted + larger secondary airports	Saltholm	Lammefjorden (+ Kastrup restricted)	Stand-still in Kastrup
1. <u>Airport construction costs</u>		-		--	?	++
2. <u>Construction costs of road and rail access(x)</u>		(-)	-	(-)	--	++
3. <u>Economic profitability of operation</u>						
(a) short term	+	+	-	-	-	+
(b) long term	-	+	-	+	-	-
4. <u>Exclusion of alternative land uses</u>	--	--	--	-	?	--
5. <u>Water, sewerage, etc., and private auxiliary services</u>						
6. <u>Length of period before start of operations will be possible</u>	+	+	-	--	--	+
7. <u>Capacity reserves at the site for later expansion</u>	-	+	-	+	?	-
8. <u>Possibility of co-ordinated operation with Kastrup</u>	+	+	+	-	+	+
9. <u>Distances between airport and population served</u>	++	+	++	+	--	++
10. <u>Land transportation economics</u>	++	+	+	++	--	++
11. <u>Probable number of passengers (and freight)</u>	-	+	-	++	--	--
12. <u>Meteorology</u>					(+)	
13. <u>Air space issues, air traffic control and safety</u>		(-)	(-)			
14. <u>Risks of birds collisions</u>	(-)	-	(-)	(-)		(-)
15. <u>Risks of crash in built-up areas</u>	(-)	(-)	(-)			(-)
16. <u>Noise annoyance</u>	--	-	--		-	-
17. <u>Conflicts with existing buildings and constructions</u>	-	-	--		(-)	-
18. <u>Destruction of wildlife, landscape and recreational areas</u>		-	--		-	-
19. <u>Destruction of agricultural areas</u>	(-)	-	--		--	-
20. <u>Accordance with regional development planning</u>		-	-	+		-
21. <u>Accordance with Copenhagen town and transportation planning</u>	--	-	-	+	-	-
22. <u>Possibilities for industrial and commercial development</u>		+		++		-
23. <u>Promotion of Danish-Swedish Sound Region planning</u>				++		-
24. <u>Attractivity for Swedish passengers</u>	+	(+)	+	++		-
25. <u>Noise annoyance over Swedish territory</u>			-	(-)		

Legend: ++ large advantage -- large disadvantage
 + considerable advantage - considerable disadvantage
 (+) minor advantage (-) minor disadvantage

(x) excluding existing road and rail connections and connections already planned independently of the airport siting (Copenhagen-Malmö road connection).

planning situation and, in addition, in cost and numbers of inhabitants exposed to noise. The last two solutions represented an even longer route.

Each solution was classified according to the following criteria:

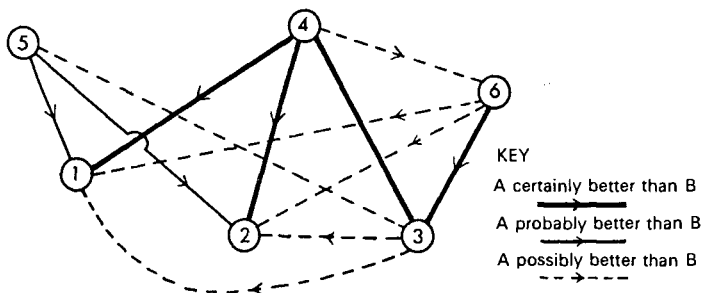
- Length of journey.
- Effect on town planning (each solution was ranked on a scale from 0 to 6: 0 = very good; 6 = very bad).
- Cost.
- Number of inhabitants exposed to heavy noise.
- Number of inhabitants moderately exposed to noise.
- Number of major historic buildings affected.
- Number of hectares of forest destroyed.
- Number of hectares of forest affected.
- Number of major woods destroyed.

The outcome of this multi-criteria comparison is shown in the following table:

Criterion	Possible motorway alignments						
	1	2	3	4	5	6	7
(1) Distance	0	0	-0.6	+3.9	+3.4	+4.9	+4.9
(2) Town planning	4	4	4	6	6	0	0
(3) Cost	511	594	1100	927	682	1104	664
(4) Inhabitants with severe noise	7.5	5.7	4.1	3.2	4.4	4.0	5.3
(5) Inhabitants with some noise	53	40	25	36	36	23	23
(6) Historic sites	2	2	2	2	3	2	4
(7) Hectares of forest destroyed	400	400	370	60	70	20	20
(8) Hectares of forest affected	880	880	670	30	30	0	0
(9) Forests affected	2	2	0	0	0	0	0

Working closely with the decision-makers, the analysts decided upon a number of ranges of values and, in particular, the one relating hectares of forest to journey length.

Using these ranges of values the following diagram of relationships between solutions was set up.



From this diagram, the following statements can be made:

- All the solutions involving a large amount of damage to forest (1, 2, 3) are certainly worse than solution 4.
- Solutions 1 and 2 are almost certainly worse than solution 5.
- Solution 3 is certainly worse than solution 6.
- At this stage no statements can be made with any certainty about comparisons between solutions 4, 5, 6 and 7 (the non-forest solutions). The only indication is that solution 4 is better than solution 6.

The most interesting conclusion from this first multi-criteria exercise was that the analysis should concentrate on the solutions not affecting forest areas. By reducing the scope of the study in this way, its costs was also reduced.

4. CONSTRUCTION OF A SECOND AIRPORT IN THE NETHERLANDS

This example has been taken from a study by Mr. Jean Paelinck(1) in which a multi-criteria analysis procedure is described(2). This must not be regarded as a method that automatically produces findings that can be followed blindly, but rather as an aid to decision-making which makes it possible to use inter-acting procedures with constant consultation between groups decision-makers and technicians. Furthermore, in the course of the exercise, the weighting patterns can be modified, uncertainties can be introduced and modulated, and further criteria added.

This example deserves attention not only because of the consultation procedure it implies but mainly because of the way in

1) Jean Paelinck: "Qualitative multiple criteria analysis: an application to airport location". Netherlands Economic Institute. Series: Foundations of Empirical Economic Research. Rotterdam 1976/6.

2) Information on this method is also contained in: P. Mastenbroek and J. Paelinck: "Multiple criteria decision making: information exhaustion, uncertainty and non-linearities", Rivista Internazionale di Economia dei Trasporti. Vol. III No. 3, December 1976.

which the weighting and ranking of criteria is dealt with. It is also of special interest because the problem it deals with has been tackled by various other methodologies, so these too can be compared.

Nine sites for the possible location of a second national airport were selected and rated by reference to the following nine criteria:

1. Particularly high investment costs;
2. Relatively lower investment costs;
3. Approach and retreat costs;
4. Urban environment, tight labour market;
5. Urban environment, possible labour market;
6. Urban environment, variety;
7. Metropolitan environment;
8. Natural environment, high nuisance level;
9. Natural environment, acceptable nuisance levels.

In fact, these criteria fall into three groups:

- economic cost factors (1 to 3);
- urban and metropolitan factors (4 to 7);
- natural-environment factors (8 and 9).

Criteria 1 and 2, 4 and 5, and 8 and 9 do not overlap; they were broken down into two dimensions in order to overcome problems of non-linearity.

These 9 criteria were applied to the 9 variants retained and the following fundamental matrix was obtained:

Scores allocated to the 9 possible sites by reference to 9 criteria

Sites Criteria	1	2	3	4	5	6	7	8	9
1	2	3	1	3	3	1	2	2	1
2	1	2	1	3	3	1	1	1	1
3	2	6	7	5	8	4	1	9	3
4	2	2	2	2	2	2	2	1	1
5	2	3	2	2	3	3	2	1	1
6	1	4	4	2	3	3	2	4	4
7	2	2	4	1	1	4	3	5	3
8	2	2	1	2	2	2	2	2	2
9	3	2	1	3	2	4	3	2	4

The number of possible permutations for weighting of all the criteria is enormous ($9! = 362,880$).

In order to reduce the analysis to reasonable proportions it was decided first of all to examine the following set of criteria weights (W_x = weight attributed to criterion x):

$$W_8 \rangle W_4 \rangle W_1 \rangle W_2 \rangle \dots$$

The aim here was to see whether certain sites could be eliminated on the basis of criteria 4 and 8 which were regarded as fundamental. It was indeed found that sites 3, 8 and 9 could be struck off.

The following three sets of criteria weights were then applied to the 6 remaining sites:

H_{1a}	$W_1 \rangle W_2 \rangle W_3 \rangle \dots \rangle W_9$	an economics-oriented weighting;
H_{1b}	$W_3 \rangle W_1 \rangle W_2 \rangle W_5 \rangle \dots$	also an economics-oriented weighting but rating first the approach and leaving costs, which were in fact higher than the investment costs;
H_2	$W_9 \rangle W_5 \dots \rangle W_7 \rangle W_1 \rangle W_2 \rangle W_3$	an environment-oriented weighting.

The following table, which gives the ranking of the different sites according to the weights assigned to the different criteria, was obtained.

Each number represents a ranking of the different sites. Numbers 1 to 120 relate to rankings in which site 1 comes first, numbers 121 to 240 to rankings in which site 2 is at the top of the list, and so on.

In terms of the first site appearing in the rankings the results are clear. If economic aspects are given relative dominance (hypotheses H_{1a} and H_{1b}), site 5 outranks the others. For environment-oriented weightings, site 6 is the first candidate except where criteria 2 and 3 gain more weight (at least $W_2 \rangle 1/7$); in the latter case sites 2 and 5 are the best.

With the aid of this procedure, therefore, which has the advantage of being both flexible and sequential, the decision-maker is free to assign what weights he wishes to the different criteria and is fully informed of the consequences of his decision.

H _{1a}	W ₁	W ₂	W ₃	W ₅	W ₆	W ₇	W ₉	Ranking of sites
	1	0	0	0	0	0	0	296, 299, 416, 419
	1/2	1/2	0	0	0	0	0	296, 299, 416, 419
	1/3	1/3	1/3	0	0	0	0	416
	1/4	1/4	1/4	1/4	0	0	0	393
	1/5	1/5	1/5	1/5	1/5	0	0	394
	1/6	1/6	1/6	1/6	1/6	1/6	0	400
	1/7	1/7	1/7	1/7	1/7	1/7	1/7	400
H _{1b}	W ₃	W ₁	W ₂	W ₅	W ₆	W ₇	W ₈	
	1	0	0	0	0	0	0	393
	1/2	1/2	0	0	0	0	0	392
	1/3	1/3	1/3	0	0	0	0	416
	1/4	1/4	1/4	1/4	0	0	0	393
	1/5	1/5	1/5	1/5	1/5	0	0	394
	1/6	1/6	1/6	1/6	1/6	1/6	0	400
	1/7	1/7	1/7	1/7	1/7	1/7	1/7	400
H ₂	W ₉	W ₅	W ₆	W ₇	W ₁	W ₂	W ₃	
	1	0	0	0	0	0	0	
	1/2	1/2	0	0	0	0	0	520, 521, 522
	1/3	1/3	1/3	0	0	0	0	520, 522
	1/4	1/4	1/4	1/4	0	0	0	521, 522
	1/5	1/5	1/5	1/5	1/5	0	0	520
	1/6	1/6	1/6	1/6	1/6	1/6	0	184
	1/7	1/7	1/7	1/7	1/7	1/7	1/7	400

SUMMARY OF DISCUSSION

FOREWORD

The scope of the subject was so wide and the literature so voluminous, that the Round Table had to limit its coverage and purely methodological aspects were therefore excluded whenever they did not affect policy. Discussion was focussed primarily upon practical methods of applying cost-benefit analysis, and upon the problems with which these methods confront the decision-maker in the transport sector.

The central issue for the Round Table was the transition from analysis to political decision. This was, however, approached in a wider context than purely that of costs and benefits; it was considered in relation to the whole spectrum of decision aids, defined as methods of analysis and appraisal whose purpose is to picture the consequences that projects on which decisions have to be taken will have.

INTRODUCTION: STATEMENT OF PROBLEM

There is an increasingly obvious need for the precise definition of appraisal procedures. The many factors calling for the development of high-precision techniques as decision aids include the following:

- In Europe there is a fairly widespread trend (in practical terms) away from market economy principles and towards more and more state intervention; in this situation, therefore, more clarity seems vital and decision-makers need to have reliable means of evaluating the likely effect of the options they take and instruments for making sure that decisions in increasingly diversified fields are compatible with one another.
- At the same time, the proliferation of the welfare state's functions and the apparent end to high rates of economic growth have made the limitations on financial resources more acutely felt and greater selectivity in investment projects has therefore become imperative. Unfortunately this selectivity is becoming increasingly difficult, because the

conflicts to which attention was drawn in the introductory report are all becoming simultaneously more acute:

- . subsidisation of public sector undertakings and transport undertakings in particular is giving rise to increasingly heated discussion as the budgetary impact of the amounts granted continues to grow;
- . the advent of environmental problems and the need to take them into account is adding to the already large number of points of conflict between planners and economists; and, lastly,
- . pressure of public opinion and electoral considerations - a national feature of the democratic system - incline politicians to favour the most spectacular approaches, which are often the most extreme, but also the most costly. Clashes between politicians and economists are steadily becoming fiercer. In this connection it is particularly enlightening to read of the conditions in which P.P.B.S. procedures were introduced in the United States.(1)

It is, therefore, essential, in order to resolve these conflicts and assist decision-makers,(2) that analysis and appraisal procedures be laid down enabling:

- discussion to concentrate on facts;
- analysis to be kept within reasonable limits, even when there is a veritable data explosion;
- pressure groups (which become all the more extremist the bitterer the conflict) to be brought to accept defeat.

However, there are many difficulties in defining and applying these procedures. These must, therefore, be carefully examined before the requirements can be specified which the procedures must meet to be effective.

1) See C. SCHULTZE, "The Politics and Economics of Public Spending". Washington, D.C., Brookings Institute, 1968.

2) By "decision-maker" we mean "the person who, in his official capacity or in officially sanctioned practice, is empowered to allocate funds; this power may be shared among several decision-makers. He may be a political decision-maker if his authority is derived from the political system, or a technical decision-maker if his powers are confined to technical matters. We are concerned with the political decision-maker, since the question at issue is the division of power between analyst and decision-maker". (X. Godard. "L'analyse multicritère dans le calcul économique. Application au cas des transports urbains." IRT., Avril 1973.)

1. DIFFICULTIES IN DEFINING APPRAISAL PROCEDURES

At first sight, transport problems seem relatively simple by comparison with, say, those involved in employment, education or health policies. This is no doubt true where research is confined to given points of origin and destination. But as soon as the scientist has to study transport projects that could cause movements of population, analysis immediately becomes extremely complex; this is especially true of all projects which may result in areas already underdeveloped becoming completely abandoned.

Transport problems which are amenable to appraisal by means of procedures such as cost-benefit analysis are really of many different kinds. Moreover, they probably vary significantly from country to country. And, lastly, the circumstances in which decisions have to be taken often differ a great deal, particularly as regards the widely varying availability of statistical data.

Several acute problems of various kinds in the transport sector, calling for the development of accurate appraisal methods, were brought out by the Round Table:

- problems associated with attempts to internalise transport factors in individuals' decision functions (for instance, the effects of road pricing on user behaviour);
- the granting of subsidies in the transport sector (particularly to railways and urban public transport), which is encountering increasing resistance;
- the building of new infrastructures, often at very high cost and whose effects on the environment are vigorously attacked;
- the running of transport infrastructures and services; this question is likely to assume increasing importance by reason of current financial constraints, which demand that better use be made of existing resources.

Even so, though the problems may be different, the methods of analysis applied remain basically the same and, what is more, they come up against the same difficulties.

Compared with the study of decisions on the building of infrastructures, that of operating methods has, it is true, the advantage of offering scope for experiment - valuable sources of information - and thus reducing the difficulties of forecasting. But this leaves intact the question of evaluation - the source of many difficulties common to all appraisal procedures.

The difficulties in all appraisal procedures are really of two types; they apply both to forecasting and to evaluation:

- Regardless of the techniques used, forecasting presents serious difficulties into which the Round Table felt it best

not to delve, their scale itself being sufficient to justify the holding of a Round Table on that subject alone. The only point it was thought important to stress was the difficulty constituted by the very high cost of working with unwieldy and highly sophisticated models - such as those concerned with national transport plans. Experience shows that the price which has to be paid each time one of these models is run through is such as to make them, for all practical purposes, useless. A figure of Fr.Frs 5,000 each time a model is used was felt to be a maximum that should not be exceeded.

- Evaluation alone presents difficulties which are just as great and the Round Table discussion centred on them. They are of two kinds: theoretical and political. The whole purpose of the Round Tables being, as it was, that the discussions should yield information relevant to decision-makers, difficulties of the latter type are of especial importance and are therefore dealt with specifically in the second part of this summary. Indeed, the effectiveness of the various appraisal procedures really depends to a large extent upon how the political problems can be solved. Failing agreement between analyst and politician, these procedures are likely, as has happened in recent years, to be diverted from their true purpose, and conflicts between the two end up with one or the other taking undue precedence

1.1 Lack of data

A time when surveys and enquiries are proliferating, and statistical instruments are becoming more and more sophisticated may seem a strange moment at which to contend that the lack of data is one of the causes of the current crisis in appraisal procedures reflected by the strained relations between politicians and economists.

Although there is a virtual explosion of statistics quantitatively speaking, presenting, incidentally, serious problems of selectivity and duplication, the quality of the data available in the transport sector is patently not what is needed. Collected, in most cases, purely for compiling annual statistical returns, they rarely meet the needs of the analyst responsible for helping in the taking of decisions.

One of the main difficulties in the making of transport decisions is the very imperfect knowledge of users' behaviour and reactions; very little is known, for instance, about changes in behaviour caused by changes in accessibility.

There are several reasons for this lack of relevant qualitative data, especially where behaviour is concerned:

- In the public sector - which is exceptionally important where passenger transport is concerned - there is a deeply-rooted mistrust of market research, bound up with insufficient interest in commercial considerations. Market research is too often regarded as being something solely for the private sector. It has to be admitted that very few major studies have been made in the passenger transport sector on subjects such as comfort, noise, frequency and so on.
- Moreover, the few behavioural research projects which have been carried out have usually been far too restricted, confined to a single mode of transport and with no continuity in time. With no attempt at any harmonized basis and often carried out in ill-defined conditions, they cannot be applied elsewhere and their range is consequently very limited.
- Evaluations largely depend on forecasts, and these, in turn, depend upon the availability of high quality, basic data. Practical experiments are a major source of information, but it must be recognised that, until recent years, the authorities have seldom shown much enthusiasm for carrying out such experiments or demonstration projects. This has meant that analysts have had no relevant information about users' actual behaviour, and prevented them from testing the validity of some of their assumptions in the field.
- Lastly, this qualitative inadequacy of the available data has also been linked recently, with the crisis in planning even though Plans have proved to be positive mines of information, and have been the reason for very high quality statistical research to provide the material for profound thinking about the future of society.

The situation being what it is, it is scarcely surprising that current appraisal procedures run into serious evaluation difficulties when non-material and intangible factors on which factual information is scarce and very difficult to quantify, have to be taken into account.

1.2 Allowing for intangibles

To evaluate non-commercial effects by simplified market simulation is an extremely questionable procedure; when it comes to taking intangible effects into account, the difficulties are even greater.

Intangible effects are those which cannot be measured quantitatively and cannot, therefore, in the present state of knowledge, be translated into monetary terms. They include not only qualitative effects, but also those quantitative ones for which no figures are available at the time the research is conducted.

Since they are often of considerable importance, particularly when the idea of the interest of the community at large is advanced, the procedures by which decision-making is assisted must take them into account; the scope of purely quantitative appraisal processes therefore seems, to that extent, limited.

a) There is an obvious difference between monetary effects and intangibles, namely the particularly inadequate nature of the data for assessing intangibles or even just taking them into account. This is partly due to the difficulty of the problem, but another reason is the authorities' reluctance to finance imaginative research on this subject.

In connection with this inadequacy of research into imponderables, it must be emphasized once again that little market or behavioural research has been carried out in this field, with the result that there is a bias against allowing for intangibles. So, for lack of really thorough analysis, the word subjectivity is used, and this is made a pretext for disregarding non-quantifiable effects. It is significant here that research should so far have disregarded so important a factor as the influence of education on the way in which intangibles are perceived.

In view of the fact that strict appraisal procedures have been developed for monetary factors, it is somewhat disturbing to have to recognise that there is no coherent, or, what is more, generally accepted system for taking intangibles into account. There are serious political risks in treating monetary and intangible effects in different ways:

- when budgetary restrictions are in force, intangibles will simply be disregarded whenever allowing for them is likely to increase expenditure;
- when the financial situation is easy, there is the opposite risk of decisions being taken purely on the basis of intangibles, with insufficient attention to conventional economic implications, which often leads to waste.

b) Whatever the method of analysis adopted (cost-benefit analysis or the multi-criteria approach) to evaluate intangibles and determine the value of certain effects it has sometimes been suggested that there should be analysis of past decisions. Such analyses, it is said, would also enable light to be thrown on other aspects of political choice, patterns of evaluation to be made more accurate and, lastly, the problem of formulating a general welfare function to be solved (see 1.3). The reasoning behind this kind of approach is simple: information is required about the nature of the decision-maker's preferences and that information has already been partly revealed by earlier decisions, so that the most objective

way of obtaining it is to analyse those decisions. This implies a certain mistrust of the decision-maker's ability to determine his own system of evaluation. This method has been used in a number of cases, particularly in Germany and in the United Kingdom (for instance, the Roskill Committee's work on the measurement of noise). Experience shows, however, that although this kind of approach to the problem of intangibles is in theory very attractive, the results of applying it in practice are usually disappointing. Analysis of past decisions often proves - as in the case of investment programmes, for instance - to be impossible, because major changes to the programmes during the course of their implementation make any comparison with the programme as originally analysed extremely difficult. Besides, all that can be measured, as a rule, is the outcome of the one course actually adopted; that of alternative courses which were discarded, yet nevertheless play a vital part in the analysis, cannot, by definition be known.

Thus, although they should not be entirely rejected, methods of evaluating intangible effects which are based upon the analysis of past decisions should be treated with great caution, for the following main reasons:

- Past decisions may be mutually inconsistent; often relating to different and conflicting patterns of evaluation.
- Past decisions may be an unfaithful reflection of the decision-maker's latent preferences. It cannot be assumed that his decisions were optimal in terms of his pattern of evaluation and that he acted entirely rationally and with full knowledge of what his decision implied.
- Lastly, even if past decisions are entirely rational and coherent, there is no a priori reason why the pattern of evaluation should remain unchanged over time. On the contrary, preferences are bound to alter depending on the way things change.

c) This study of procedures based upon the analysis of past decisions illustrates the difficulty of developing systematic methods for the evaluation of non-quantifiable factors. At the same time, it is impossible to be content, for the purposes of appraising transport projects submitted for decision, with mere economic data in the conventional sense, i.e. those which are quantifiable in money terms; these plans are so important that it is vital to take intangible factors into account and to include "soft variables". However, in view of the problems involved in all techniques for evaluating intangibles, it is clearly futile to attempt to attribute a monetary value to them, since they are governed by a rationale which is not economic. Methods should be devised enabling use to be made of the valuable information of a qualitative kind which exists as to these effects,

and non-statistical methods should be devised for taking them into account. It would be particularly useful from this point of view to institute some research into the effects of transport upon land-use and on various activities. It would be wrong to be over-ambitious, therefore, as regards the evaluation of intangible factors. All in all, problems involved in taking imponderables into account are more likely to be solved by having recourse to approaches based upon co-operation between analysts and decision-makers.

Methods of this kind, following upon a purely physical assessment of intangibles, and after being submitted to politicians, should enable the latter to determine the respective social values to be attributed to the intangibles by way of a qualitative evaluation. Such values will usually be quite sufficient for reaching decisions, since in most cases a purely monetary measurement of imponderables is not necessary. There does not seem to be any advantage in covering up the problem of the relative value of social preferences; on the contrary, it should be brought to the surface and decision-makers shown the consequences of their own scales of social values. Multi-criteria analysis seems to offer interesting possibilities in this field.

The evaluation of imponderables, then, leads directly to the particularly nebulous and controversial area of collective preference. It is beyond doubt that the solution of the problem of making allowance for intangibles depends mainly upon how the difficulties of arriving at a social preference function are overcome.

1.3 Working out a general welfare function

Every investment project has certain objectives. It follows that whatever procedures for assisting decision-making and processes of evaluation are used, they imply the need for defining the criteria by which the various options are to be judged and for weighting these criteria.

It is a comparatively simple matter to define aims and criteria of evaluation at microeconomic level; but many difficulties have to be faced when projects affect collective welfare and when decisions have to be taken from the standpoint of the community and this is usually so in the case of decisions by the authorities concerning the transport sector.

To overcome these difficulties, economists have been trying for a long time to devise general welfare functions, the maximisation of which could serve as a guide to decision-making. However, working out these functions gives rise to such problems and is based upon such assumptions that today they are increasingly being challenged.

The crucial difficulty about preference is no doubt primarily due to the present controversy about the very framework of the

analysis, a controversy which, in turn, is linked with the crisis through which economic science is currently passing. This conflict over theory emerged at the Round Table, where it was clearly impossible to reach agreement on how the criteria to be applied in appraisal procedures should be arrived at and weighted.

a) According to one view, the question of social preference functions has already been very satisfactorily dealt with in the literature, and requires no further discussion. The adherents of this view consider it is perfectly acceptable to base a general welfare function on individual preferences as they express themselves in the market using the five following key assumptions:

- The welfare of the community is a question of the satisfaction of its members.
- The factors determining the satisfaction of the individual can be defined.
- A given individual will maximise his satisfaction within the limits of his income; this is the central assumption justifying the use of prices as a criterion for individuals.
- The distribution of the community's income is optimal; the community has no preference in terms of the allocation of money to this person rather than that.
- Collective utility is equal to the sum of individual satisfactions.

This, of course, is a simplified formulation which summarises the main assumptions. Further assumptions are concerned with points such as the fact that no individual can affect the price system, that the community's goods and services are fully utilised, etc.

The advocates of such an approach consider that these assumptions are reasonable and enable a very simple welfare function to be constructed which measures the difference between two states of well-being as being equal to the changes occurring in the consumption of goods multiplied by their price. This function can be supplemented, moreover, by the following factors:

- A measurement of the changes in consumption which do not give rise to any satisfaction, such as the cost of removal forced upon a person by a planning decision, or increased transport costs due to lack of road improvement.
- A factor to represent the change in the economic situation of organisations; it may be defined as actual net value as used in discounted cash-flow calculations, i.e., in broad terms, profit.
- Other economic factors such as under-employment of resources or the balance of payments.
- Effects on intangibles.

b) Although some of those taking part in the Round Table regarded such a function as well-established and the assumptions underlying it as perfectly acceptable, it was vigorously contested by many others. The latter held it to be very unsafe to base cost-benefit analysis on individual or collective preference functions which depend upon too many assumptions and are not founded upon any logical basis, for they assume a rationality in human behaviour which does not exist. Such being the case, analyses of this kind are likely to mask the underlying assumptions and do not, therefore, lead to a valid solution of the problem of defining collective advantage.

It should be emphasized first of all that there are many difficulties in the transition from individual to collective preference which have not yet been satisfactorily solved. The example of congestion is clear proof that the process of individuals taking rational decisions does not necessarily lead to a collective optimum: at a given point in time, it may be quicker to use the car than to take the bus; but the switch of users resulting from this rational decision empties the bus service and increases congestion to such an extent that a vicious circle is initiated, the final outcome of which is worse than if everyone had chosen to use the bus.

Moreover, when constructing welfare functions analysts have been too much inclined in the past to regard individual preferences as equal and identical, and this has made for measures such as the evaluation of noise by reference to the housing market. Individuals have different orders of preference; consequently, when a collective preference function is being worked out, allowance should be made for the fact that people are affected differently; this brings us to the difficult problem of compensation, for which no satisfactory solution has so far been found in any of the theoretically calculated welfare functions. Again there is an interdependence between individual decisions, and this fact calls for due consideration. This, incidentally, is an endogenous phenomenon and not, as has been too frequently believed hitherto, an exogenous one, and this is why that interdependence has been overlooked when social preference functions were being worked out. Altogether, these considerations not only cast doubt upon the conventional methods of constructing collective utility functions, they also highlight the need to develop disaggregated, multi-agent analyses for appraisal procedures.

More generally, the criticism levelled at analyses, especially cost-benefit analyses, is that their mathematics have hitherto been based too exclusively on individual behaviour and have failed to incorporate freewill aspects, or criteria such as acceptability; yet the latter can be taken into account by procedures such as multi-criteria analyses, which is certainly one of the most conclusive advantages of that type of approach.

c) Because of all the weaknesses in the conventional approach to the welfare function based on individual behaviour as reflected in the market a different method of determining criteria and objectives needs to be put forward. In reality, the crucial issue which has to be faced is whether prices or political weightings should be used to express individual choices. Many of the experts take the view that, because of the shortcomings of the prices approach, politicians have to set the objectives and define the weightings for the evaluation criteria. Advocates of this approach see nothing wrong in politicians deciding objectives and imposing their own scales of values; after all, their values are necessarily very close to those of the community, seeing that - at least in a democracy - a politician must be heedful of public opinion. The only objection is that public opinion is often very badly informed about overall plans and is thus unlikely to be in a position to make its real preferences known to the politician.

A further consideration is that since this approach is based essentially upon concertation, it has the advantage of involving the politician directly in the process of evaluation, and thus moderating or at least clarifying conflicts between analysts and decision-makers. It may thereby go some way towards lessening the distrust that politicians now have for procedures for assisting decision which, with the conventional approach, they feel gave undue importance to the analysts.

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In conclusion, however, it would be wrong to overrate, at practical level, the effects of this conflict between supporters of the market approach (prices) and those who favour the political weighting of criteria, since experience suggests that the two do not lead to very different results. At the same time, the impossibility of reaching general agreement on the method of defining and weighting criteria is undoubtedly troublesome from the political standpoint. If cost-benefit analysis, or any other kind of appraisal procedure, is to be recognised by decision-makers, it is vital for analysts to reach a minimum level of agreement among themselves as to how welfare should be assessed. This problem calls for serious discussion if politicians' distrust, which, as the introductory report has shown, lies at the root of the crisis currently affecting appraisal techniques, is to be allayed.

What emerges from the study of how a welfare function can be developed is that the difficulties encountered are, basically, very largely the outcome of a more general problem, namely the crisis which the social sciences, and particularly economic science, are currently undergoing. Economists, and particularly specialists in

macro-economics, are being frowned on; their tendency to propound unverified laws has done a great deal to diminish the confidence of the public and decision-makers. Moreover, the difficulty they have in offering satisfactory answers to decision-makers is all the greater in that, as the Round Table showed, there is no common ground between them even as regards the theoretical bases on which their analyses rest. There is thus an urgent need for them to reach agreement on a number of fundamental points concerning the theoretical approach to problems.

As far as appraisal processes are concerned, however, the conflicts of view between economists have boiled down to questions of methodology bound up with the problem of working out a social welfare function; advocates of conventional preference functions are more in favour of cost-benefit analyses, whilst supporters of political weighting of criteria recommend multi-criteria approaches. This shows the lengths to which theoretical disputes among economists may be taken - with the effect this has on the credibility of all their analyses. Such an attitude is all the more to be regretted in that a careful study of the different methods of evaluation shows that, far from being in conflict, they are in fact very similar and complementary.

1.4 Choice of evaluation method

In recent years, conflict between economists over methodology has hinged mainly upon the rival merits of cost-benefit and multi-criteria analysis.

a) Supporters of the cost-benefit approach emphasize that the part played by this type of analysis in decisions in the public sector is akin to that played by profit or the return on capital in the private sector. Thus, they argue, cost-benefit analysis can assist decision-making at all levels, whether the decisions are strategic or tactical, minor or major, and so on. At all events, the basic principle of cost-benefit analysis founded upon the ascertained preferences of the members of the community ought always to be at least the starting-point for multi-criteria approaches.

b) Multi-criteria analysis, for which, by the way, there is a variety of methodologies (cf. annex to introductory report) is a very attractive approach and a valuable source of data.

Advocates of the multi-criteria approach argue, as regards the market values applied in cost-benefit analysis, that where transport is concerned, the decisions which have to be taken are usually of a social kind. Now, in this context, the price system on which cost-benefit analysis is based is rarely satisfactory. This being so, it is the analyst himself who, in the end, has to decide the weighting of the criteria. Apart from that, the inadequacy of

conventional economic values, i.e. prices, is, in some cases, particularly blatant e.g. the price of land, the real value of which is very different from its price by reason of interest rates, taxation, etc.

With multi-criteria analysis, however, the decision-maker is involved and the social preferences of policy-makers introduced, thus dealing neatly with the problem of intangibles and distribution effects. What is more, whereas in cost-benefit analysis the frame of reference, i.e., prices, is fixed once and for all at the start of the evaluation, in multi-criteria approaches there is no need to have a single frame of reference from start to finish for the appraisal process; different weighting criteria can be used for each comparison.

It is often pointed out, in favour of multi-criteria procedures, that they have the advantage of leaving the final decision-maker far wider scope; for he is presented with a complete set of results and a range of choices. This, it is argued, frees him from the danger of single criterion procedures, which ultimately tend to impose a single solution, with no real choice. As against this argument, it may be pointed out that, on occasion, experience with multi-criteria matrices has shown that politicians are often unable to indicate coherent preferences; they are usually at a loss when faced with the complexity of these studies, which therefore tend to give the analyst a very important role. In reality, there does not seem to be very much difference between the two types of analysis as far as the respective positions of the politician and the analyst are concerned. If the politician's freedom of choice is the main yardstick, neither seems any better than the other, as in any case there are always some factors in the analysis which have to be left out to prevent excessive complication and to reduce the cost. Actually, in this field, everything depends on the conditions in which the evaluation procedure is organised, and above all on the establishment of an effective consultation procedure (cf. 2).

c) There is, then, no lack of arguments for and against both types of analysis. Discussion did not really bring about any settlement of the issue between cost-benefit methods and multi-criteria procedures. In this connection, however, it should be put on record that a multi-method approach is undoubtedly an interesting one, costly though it may be; it is certainly most instructive to apply sensitivity tests to the different techniques of analysis for the various results.

A careful study of the arguments put forward, however, does allow two important conclusions to be drawn as regards methodology:

- cost-benefit and multi-criteria methods have their respective fields of application; and

- the two are complementary.

* The choice of method depends primarily on the type of decision under consideration and the data available. The various methods ought really to be viewed as part of a range comprising the following:

- . intuitive analysis, which forms the first stage, and is essential when information is scarce; an example is the drawing up of a long list of alternative solutions;
- . intermediate methods, required when information is still comparatively scarce, but some analysis is possible;
- . analysis with quantified evaluation of all factors involved (like cost-benefit calculations), applicable only where the information is comparatively reliable, e.g. at that stage in the analysis at which a very short list of alternatives is drawn up. There are many problems in which this stage is never reached, if only because the economic implications of the decision, or of the higher accuracy in the evaluation, are not such as to justify the cost of collecting the necessary data.

Multi-criteria methods seem more particularly suited to situations of the second type, i.e., where some form of analysis is possible, but the quantitative information available is comparatively scarce.

* Far from conflicting, cost-benefit and multi-criteria methods are really complementary; in fact, the use of the multi-criteria approach in other appraisal techniques is desirable. The complementary nature of the techniques of analysis is already apparent at the criteria weighting stage, a problem which arises in all but the simplest cases with a single predominant criterion.

Rather than considering this problem as a question of whether politician or analyst (basing himself on the price system) is to decide on weighting, the more effective course seems to be to divide criteria into two classes:

- . Those which lend themselves in the main to the cost-benefit analysis approach; these criteria relate to economic factors in the conventional sense, and those to which unequivocal monetary values can be put. The weightings for these criteria should be deduced from prices or from ascertained preferences.
- . Those which do not fit into that system, in other words criteria like risk, the difficulty of negotiation with trades unions, and so on. Here politicians have to be

asked to specify their scales of preference, and multi-criteria analysis can provide valuable help.

At some point between the two main methods of evaluation, there is also the intuitive realisation that a time must come when cost-benefit analysis can go no further for lack of data or real evaluation possibilities and the substitution rates which have to be used will cease to have any connection with the price system. Because it embodies those very factors which cannot be evaluated in money terms, multi-criteria analysis enables the analysis to be taken beyond that point. Thus, the two techniques are complementary. In fact it is only by integrating the two that a really satisfactory evaluation can be arrived at. Whenever a decision has slightly complex effects, it will really be desirable and useful to carry out a broad, multi-criteria analysis, taking into account the findings of cost-benefit analysis (in the form of an evaluation in money terms) on the one hand, and other factors, especially the intangibles, on the other.

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In spite of the recent enthusiasm for multi-criteria analysis, with its undoubted advantages, it must still not be forgotten that an adequate return, i.e., profit, is still an indicator which must be heeded, or waste will result. There is no denying the value of cost-benefit analysis in this respect, which should never, therefore, be dispensed with. Cost-benefit analysis and multi-criteria methods, then, do not appear to be in competition; on the contrary, they are in some ways closely related. Where there is an unrelated assortment of factors to be taken into account they are complementary and dovetailing ways of reducing things to order and thus assisting decision-making.

Last - and more important than the choice of actual methods and hence of general welfare functions - is the question of the practical conditions in which evaluation techniques are put into operation, that is, the framing of a procedure which will provide a broad view of the problem, embracing every option, and also take the various viewpoints into account by arranging for consultation on a wide basis. These arrangements are far more important in determining the effectiveness and, above all, the political practicality of evaluation procedures than the procedures themselves.

2. BASIC CONDITIONS WHICH APPRAISAL PROCEDURES MUST MEET TO BE EFFECTIVE

As the foregoing discussion has shown, there is no satisfactory and generally accepted answer to the theoretical difficulties of

appraisal procedures. However, a careful study of cases of appraisal procedures in recent years shows that it is their practical application rather than theoretical problems, which has given rise to disagreement, especially between politicians and analysts, and caused these methods to be challenged. The first need, therefore, is to study these conditions.

To be effective, i.e. to be practically and politically suitable for use, evaluation procedures - whatever solutions may be advanced to the theoretical problems they raise - must be founded upon:

- . accurate and comprehensive analysis; and
- . analysis that is based on consultation and information.

2.1 Accurate and comprehensive analysis

a) Accuracy

Situations differ from country to country, and even within a single country and evaluation procedures never therefore take the same form or apply to problems of similar scale. Within these different situations, too, there are greatly differing requirements as to the data needed for the analyses. Since information is costly, and because there is often too much, data requirements must always be optimised. Thus, although the basic principles of evaluation are not affected at the theoretical level, efficiency requires that the field of analysis should be precisely defined before any appraisal procedure is evolved in the transport sector. For this purpose, certain distinctions have to be drawn, in particular:

- Between the problems posed by the creation of a new feature of a system and those raised by the operation or management of that feature. Cost-benefit analysis seems to be particularly well-suited for the evaluation of measures of operation or management; these usually present much simpler problems than do investment projects, where multi-criteria approaches are often needed because of the difficulties encountered in quantifying certain effects. This distinction is particularly important in the current climate of restricted financial resources, with the resulting emphasis on better utilisation of existing infrastructures. At all events, it is vital that appraisal procedures, whatever their kind, should deal with these two well-defined types of problem; in particular, investment decisions should never be considered independently of decisions concerning management and operation of those same investment projects. More generally, strategic and tactical decisions must be combined if a rational outcome is to be reached. In this field, there are

frequent instances of serious inconsistency, because different criteria are applied, between investment decisions governed by non-financial criteria and management decisions for the very same projects, in which only financial criteria are applied. If this kind of contradiction is to be avoided, it is essential that, in the course of every evaluation of an investment project, the way in which the scheme will actually work should be simulated and all the implications considered. The more clearly the schemes under examination are defined, and the smaller their scale, the more easily this simulation is.

In the absence of an accurate analysis for both investment and operation aspects, there will inevitably be points of variance between operation in practice and what was designed in the project (as in the case of the evaluation of a projected underground railway which allowed for round-the-clock operation whereas, in reality, the railway only runs until midnight, and then only on working days) which cannot fail to impair the credibility of the procedures used to assist decision-making.

- Between large, one-off schemes where politicians' first need is a great volume of data and small, repetitive projects for which they chiefly need a coherent framework of thought and as it were a system which virtually does the choosing itself. For large projects, politicians should be very closely associated with the task of evaluation. Since the effects of such projects are often far-reaching, the political decision-maker must be enabled to justify every step taken, at any time, which means that he must be fully informed of the factual basis of the analysis, its methods, and so on. In evaluations of this kind, the analyst must never decide himself; his sole function is to present a picture in which the data which the politician needs as a basis for his decision are set out. This is where the politician's role is paramount and he needs to be able to defend his position, and it is significant that it is usually for the largest, i.e. strategic projects, that the biggest budgets are earmarked to pay for collecting the information necessary for thorough investigation.

Conversely, where decisions of a repetitive kind are concerned, politicians do not usually have the time to weigh up all the data and decide themselves. Thus, being unable to consider the evaluation in detail, all that the decision-maker wishes, or is able, to do is to vet the evaluation procedures used and the assumptions agreed in the analytical

process. All in all, cost-benefit analysis appears therefore to be much more useful for repetitive projects, i.e., series of small schemes, for which it offers undoubted advantages of simplicity and economy, than for major investment decisions, where it is not capable of clarifying matters for the decision-maker because the implications are so varied. By providing the decision-maker with the coherent system of evaluation he needs, it enables a sequence of decisions to be set out in the light of available resources.

Conversely, where relatively large-scale projects are concerned, multi-criteria approaches seem more suitable for they provide the decision-maker with more varied, and above all more relevant, information than the financial data - often impossible to interpret, incidentally - yielded by cost-benefit analysis. Even though multi-criteria procedures do not invariably offer clearcut answers to the problems of choice which arise, they produce a substantial volume of information and thus always make for clearer understanding of the decisions to be taken. The inference from this is that the technical, and even theoretical, problems of evaluation procedures are in fact much larger in small projects than in large ones, where the politician rightly plays a major part. Agreement on technical standards is certainly vital in the case of small-scale projects - which, incidentally, are often the repetitive ones - for once it has been reached, it enables a succession of minor decisions to be made without the decision-maker being deeply involved. Conversely, where large-scale projects are involved, what matters above all is that the practical conditions in which methods of evaluation will be applied should be accurately determined, and particularly that a procedure should be established which will the whole time enable viewpoints - especially the political decision-maker's - to be taken into consideration. Admittedly, it would be futile to deny that one of the most recalcitrant problems yet to be solved is that of defining large-scale and small-scale projects, for experience shows that the financial implications are not a sufficient yardstick.

There is no conflict at all between the need for accuracy in analysis and hence the need to optimise the collection of information and use the most relevant procedures of analysis, and the need for a widened field of analysis. On the contrary, the two requirements are fully complementary: accuracy of analysis involves distinctions which, in turn, require information that, though within clear limits, must be very varied and wide-ranging.

b) A wide field of analysis

To be effective, procedures to assist decision-making, whatever their kind, must not be conceived too narrowly. To avoid their results being challenged after the event, they should embrace all possible solutions and consider all their implications.

- First and foremost, the alternatives examined should be spelled out, and the list should be as complete as possible. Analysis, or the evaluation arrived at, should not be confined to the transport sector alone. From the outset, appraisal procedures should allow for alternative projects in other fields, for it often happens that the same aims can be achieved more efficiently by policies that have nothing to do with transport, e.g. land-use planning, redistribution of income and so on. Accordingly, when the alternatives are listed it should not be forgotten that transport policy is only part of a more general policy. There is no doubt that the reason for criticisms levelled against various appraisal procedures has often been too narrow an outlook in proposing alternatives. Options have been differentiated too restrictively; there has often been a tendency to exclude those which seem impracticable for policy or financial reasons. A priori decisions of this kind are wrong and do not help in ultimately choosing the best solution. It is important to have a good number of options at the first stage of any appraisal process, and in particular to include extremes not forgetting the zero option which means doing nothing, or, more precisely, allowing present trends to continue. For a satisfactory evaluation, therefore, there should be no compromise, in the options analysed, until extreme solutions - which, by the way, may be usefully put forward by external pressure groups - have been properly assessed. The point is that very often one of the analyst's most difficult problems is to make decision-makers, who frequently look to appraisal procedures simply to confirm a choice they have made in advance, realise that alternatives exist.
- In the evaluation process, economists should never ignore what they consider to be external factors, that is, not capable of economic evaluation. The analytical process must be widened. It is this failure, in the past, to take imponderables, intangibles and the various motivations which bear upon decision-making sufficiently into account that has helped to make appraisal procedures suspect, particularly to politicians. So it would be wrong to confine analysis solely to what is quantifiable, since this would greatly limit its scope. Moreover, in their analysis, economists have been

too much inclined to pay insufficient attention to financial factors, and particularly to long-term financial implications, and this, too, has provided politicians with arguments for disparaging their work.

- Every transport project - whether it be an operational or investment project and whether individual or repetitive - has different effects on different population groups; it inevitably has redistributive effects on income, and every evaluation should take these into account. However, these are not the only effects: a specific feature of transport projects is, for instance, that they alter various social groups' conditions of accessibility. Now, these groups are not just income groups; they are also geographical groups. For a truly relevant evaluation the analysis must never disregard this kind of effect. In this connection, special attention should be paid to the connections between transport and land-use, which have not been investigated thoroughly enough in the past.
- Lastly, no appraisal procedure should fail to deal with long-term effects. In his analysis, the economist should examine the investment project itself, i.e., its short-term consequences and its operation but also its long-term impact, including that in fields outside transport. It should nevertheless be stressed that the incorporation of the selected time-horizon in the analysis does give rise to some problems which have not always been satisfactorily solved.

It is easy to see from what has been said that the definition of the field of analysis as described is a comparatively complex matter with a different answer in each case, particularly as regards selecting the options. So it should not be left, as has happened too often in the past, to the unaided judgment of the economist, or politician, alone. The definition is possible only as a result of close consultation between all the parties concerned. The provision of procedures ensuring consultation and two-way exchanges of information among the various people involved is undoubtedly vital to the establishment of effective and universally accepted appraisal procedures.

2.2 An analysis based on consultation and information

Every evaluation technique and every type of aid to policy decision-making begs the question of the real power of decision. Techniques, as everyone knows, are not neutral and in practice give a varying degree of de facto power to the specialist. The point is that selection procedures must unquestionably help in the making of decisions, but must not take over that function, otherwise politicians will refuse to use them.

The question of how power should be shared between analysts and decision-makers is thus of capital importance and yet this question has been largely ignored in the literature, and what is more, whilst some theoretical work has been done on the subject, examples of satisfactory practical applications are rare.

If effective and universally accepted appraisal procedures are to be introduced, therefore, the relations between politicians and experts should be studied with special care. Politicians' dislike in recent years for techniques such as cost-benefit analysis may be largely put down to the fact that the specialists, convinced of decision-makers' inability to understand the specialist's work, attempted to use this kind of analysis as a means of imposing their own solutions on decision-makers without real consultation or genuine exchange of information. Yet it is wrong for politicians to be systematically underestimated by analysts. As experience has shown on recent occasions, decision-makers, that is, Ministers and their officials, are perfectly capable of using the planning instruments which techniques such as cost-benefit analysis provide, and acquiring a sound understanding of methodologies. Conversely, if in return politicians found it easy, in the past, to disregard the work of the economists and to show little inclination to make known their own real scales of preference, it was because any possible waste attributable to their "intuitive" type of policy-making was of no great consequence in a buoyant economy. It is clear that, with present constraints on resources, accentuated by the return to moderate rates of economic growth, politicians will in future be far more ready to listen to economists and co-operate with them.

Analysis shows that improving relations between politicians and economists is largely a matter of organisation; the way to resolve differences between decision-makers and analysts - the key problem which in fact gave us the effectiveness of all evaluation procedures - is to organise communication between politicians and experts as part of the process of analysis. This can be done only by broad consultation and the systematic exchange of information.

a) Consultation procedures

This is a fundamental question for the future of all appraisal procedures and it was central to the Round Table discussion, essentially concerned with the political aspects of their application. The number of people affected by a decision, and thus having an opinion on the matter, is usually very high: government, politicians, ministries and departments, local authorities, people directly affected, and so on. If evaluation processes are to be fully effective and politically acceptable, consultation procedures involving all these concerns are essential.

General and continuous consultation to bring the preferences of the various people involved to the surface, is really the only way of resolving conflicts and settling problems, in particular those of establishing general preference functions or the weighting to be given to the various criteria used in the analysis. It should be emphasized, however, that nothing can do more to facilitate the establishment of that consultation than a thorough study of the way politicians and administrations work, and the factors which play a part in their decisions.

i) General consultation

The need for general consultation is shown by the high degree of sensitivity of results of tests on the value attributed to different parameters, so much so that even where identical analysis logic is used (e.g. cost-benefit analysis) different bodies affected by a decision come to different conclusions. Ways therefore have to be found of making it easier for a compromise to be reached between the centres of decision and of research. The fact is that analysis, whether cost-benefit or multi-criteria, will never qualify as an objective method producing a single, unanimously accepted result; each has its weaknesses in this respect, which the various bodies involved in a decision readily exploit to suit their respective interests.

- Whatever evaluation procedure is used there should never be any disconnection between political and research phases, in other words, between final decision-maker and evaluation specialist. Similarly, there must be no phase difference between the various decision-making bodies at the administrative and political level and especially between the responsible Minister and his departmental officials. One important precaution is to guard against the risk of divergence that is present whenever the decision-maker and the official with financial responsibility are not the same person and to bear prevailing budgetary restrictions at macro-economic level in mind, since they mean that a project for which the evaluation procedure results in a favourable verdict may nevertheless have to be tamed down. This is certainly a factor which should not be overlooked in the present economic climate, when increasing stress is laid on the financial aspect of investment. To overcome these difficulties, machinery should be set up for regular consultation between analysts on the one hand and political leaders and officials on the other. In particular, it is vital that the officials responsible for implementing the measures being studied should be involved at the analysis and evaluation stage. For this it would seem

best to have joint scientific and administrative teams, for the danger of rivalry between analysts and administrative officials should not be underestimated; a further point is that teams of this kind can play a significant part in training the officials who will have to carry out the decisions. In cases where outside research bodies or consultants, i.e., concerns in the private sector, are brought in to carry out evaluations, co-operation and consultation between decision-makers, administrators and analysts is less easy. In such cases, therefore, interim reports should be drawn up at intervals by the experts and discussed with all interested parties.

- It is no less important to consult public opinion. The evaluation process should not be confined to the firm of consultants, or the technical department in the Ministry. People and bodies outside the Departments concerned should always be consulted on the strategic documents about the specific projects that are being considered. In some countries, lack of consultation of this kind has particularly unfortunate effects as far as parties of the political opposition are concerned; their very restricted access to the research material on which the decisions are based robs political discussion of much of its effectiveness. It is important to arrange consultation procedures so as to take account of pressure groups and their demands, and this should be done right from the start. This is another reason why extreme solutions should always be included in the analysis. A referendum is another way of sounding out public opinion. However, this form of consultation does present the problem of ensuring that the people consulted are fully informed, for as a rule they do not know all the implications of a decision. Underlying the arguments for consultation by referendum there is in fact a certain confusion between individuals making a choice with regard to specific goods or services, and the possibility of expressing a preference as regards general projects; an individual may be very clear about his preference with regard to particular goods or services, but public opinion is, in most cases, very badly informed about general projects and does not grasp what they really involve. Such being the case, a referendum can produce valid information only if it is accompanied by measures to educate those to be consulted. This must inevitably be a very costly procedure, and can only strengthen the rôle of politicians as representatives of public opinion in the definition or weighting of criteria and lends fresh emphasis

to the importance of consultation with them. On the other hand, this should certainly not be read as a blanket veto on the use of public opinion polls in certain cases, because our political leaders are not always aware of the real reactions of public opinion to a new measure, the introduction of road pricing for instance.

The referendum is probably too laborious a procedure, and unjustifiably expensive in most cases, but experience nevertheless leaves no doubt as to the need for dialogue between the technical experts and people with certain preferences in the area under analysis, particularly when the latter's attitudes cannot be expressed on a market, in terms of price. Evaluation ought, therefore, to proceed on a basis of open-door co-operation, allowing wide-ranging consultation, whereas normally analysts and officials are expected to be very secretive about the methods and results of the evaluations in which they are concerned.

Confirming the need to develop general debate in this way, many participants in the Round Table supported the proposal in the introductory report that up to one-third of research expenditure should go on promoting consultation, especially with politicians and public opinion. This should not, however, be regarded as casting doubt on the creativity of analysts and on the value of their work. It may be relevant, though in another field, that Walter Gropius, one of the most creative artists in Germany, said he spent up to 80 per cent of his time in negotiating with men in political life. In reality, it is not through the systematic search for an hypothetical, single and objective result using sophisticated techniques that economists will extract maximum effectiveness from their work, but by falling in with the compromises reached by general consultation. In practice, moreover, the success of evaluation procedures in the past has been in direct proportion to the:

- competence of the expert responsible for the study;
- his ability to convey to administrators and politicians the pros and cons of proposed measures; and
- his skill in presenting his findings to the various social and business groups concerned.

Satisfaction of the last two conditions, of course, presupposes, as has been shown above, arrangements for general consultation, but it also requires the establishment of continuous discussion among all the parties concerned.

ii) Continuous consultation

Whatever the nature of the project, the experts need in each case a substantial volume of data if their analysis is to be really

thorough, and the only way to obtain these data is by permanent consultation among all the parties concerned. This exchange of views, initiated at the very outset of the evaluation procedure, should be maintained throughout the process and when necessary repeated - to identify variants to be examined, select and weigh their evaluation criteria, arrive at qualitative evaluations, and so on - all of which will produce part of the results that are wanted.

- The Round Table emphasized the importance of the period prior to the actual evaluation in every procedure for deciding on investment options, when the field of analysis is being defined and the alternatives identified. The definition and listing of possible options in consultation with the decision-makers and taking the views of pressure groups into account - by including extremes - is vital to the effectiveness of any evaluation process. It could be serious if politicians were able to assert, after the event, that some options had been ignored by the analyst, and contest the chosen criteria. So it is essential to involve politicians in the process of analysis from the outset, and to work out exhaustive option matrices jointly with them. There should be no arbitrary, preset limit to the number of variants or criteria. Here a great effort is needed from politicians to overcome their natural tendency to retain control of certain variables and to keep some of their ideas to themselves.

In terms of effectiveness, compilation on the right basis, that is to say in concert with the decision-makers, and also with public opinion and pressure groups, of the list of alternatives at the very outset is therefore essential and probably more telling than the choice of evaluation technique itself.

- Continuous consultation, based on iteration and adjustment, as the analysis of variants proceeds, is the only way in which the decision-maker's pattern of evaluation will gradually come to the surface and a solution be found to the problem of the intangibles. The Round Table laid much emphasis on the need for this gradual process; when the decision-maker formulates and applies his evaluation pattern it is important that he should be aware of its implications so as to correct, if necessary, his first choice. In assessing any project, the analyst is initially faced with a number of technical data reflecting a cost, but it would be a bad mistake to begin by taking only these quantitative data into consideration and to introduce the "soft" variables into the analysis only subsequently. From the very outset, it is essential to know where the politicians interests lie and to feed in the

variables he has most in mind, even if they are usually intangibles. Again, once the list of options and criteria has been compiled, there is the difficulty of deciding on the weightings to be given to the various evaluation criteria and factors. Some very "soft" variables are difficult to judge and therefore to fit into the evaluation; this applies particularly to all factors relating to collective preference. To overcome this difficulty, it is vital to combine the various methods of evaluation - cost-benefit analysis, multi-criteria analysis, etc. - in a continuous dialogue among all the interested parties. Not only must "hard" financial calculations (costings, in other words) be used but, from the start, intangibles and imponderables must also be taken into account by the use of multi-criteria procedures based on a continuous shuttling of views between decision-makers, analysts and public opinion. In this dialogue with the decision-makers, incidentally, the coherence of the preferences they will have given initially needs to be continually checked - a further illustration of the need for very close consultation. Both types of evaluation - the financial calculation and the assessment of intangibles - should feature in the final picture placed before the policy-maker. Conventional cost-benefit analysis is in fact only one of the instruments of appraisal used to paint the picture, which is the result of general consultation and continuous dialogue, given to the politician, whose ultimate responsibility the decision is.

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The organisation of general and continuous consultation in all cases is, then, a vital condition if analysis is to be fully effective and if economic calculations are to provide the right guidance for policy decisions. However, unless it is sustained by a systematic exchange of information among the various parties concerned there is a risk that it will be a mere formality, and fail to resolve the latent conflicts that are always present between politicians, experts and public opinion since otherwise it will not be possible to achieve an effective (i.e. generally acceptable) division of the functions involved in the appraisal process, especially between analyst and decision-maker.

b) Full information

In a process of evaluation, the exchange of information should be two-way. In particular, the politician must let the analyst

know his preferences. In this field, however, the problem that has created most difficulties in the past has certainly been the transmission of information from expert to decision-maker and public opinion, and this has done much to generate conflict between analysts and decision-makers. The truth is that one of the greatest difficulties in the way of procedures for deciding on investment projects in recent years has undoubtedly arisen from the serious inadequacies in analysts' presentation of the analytical processes used and of the results arrived at, whether to politicians, government officials or public opinion.

i) Information on methods

If the economists' work is to have any real impact on policy decisions, it is essential that analyst and decision-maker be in agreement, at the outset and throughout the process of evaluation, on the general way in which the analysis is to be conducted, i.e. the method of evaluation. The Round Table emphasized the need to use the simplest possible theories for the analysis of investment projects to facilitate the dialogue with politicians. In those instances where highly sophisticated methods have to be used, there is obviously a limit to the amount of theory that should be included in any submission to the decision-maker. At the same time, economists should no longer underestimate politicians in this field. Experience shows that decision-makers, assisted by their own technical staffs, are perfectly capable of acquiring a sound understanding of techniques. Organising consultation, as described above, can go a long way towards making it easier for analysts and decision-makers to reach agreement on questions of method. But the Round Table was especially concerned to stress the requirement on analysts to inform both decision-makers and public opinion. Whilst it is important that the information given by analysts be simple and clear, they must nevertheless accurately describe their line of argument and the path they have followed in their work. It must be made possible for the decision-maker to understand the instruments of evaluation used by the analyst, otherwise his participation in the process loses all meaning.

- It is obviously difficult, for instance, to ask politicians to decide on weightings for assessment criteria if the analyst is not prepared to explain exactly what the weighting is to be used for.
- Similarly, the experts should clearly outline the process by which options have been chosen for evaluation. In particular, before embarking on the evaluation procedure itself, they should state exactly how they have come to select only a limited number of variants for analysis.

- Lastly, it is vital that the analysts should give decision-makers a clear table of objectives and criteria, setting out what objectives or alternatives have been considered and what criteria selected in the analysis for often, during the course of evaluation, economists add certain variants or criteria not originally envisaged. These must not be concealed from the politician, or he may well throw out the results of the assessment.

With a view to clarifying the experts' methods for the benefit of decision-makers and administrators, the Round Table showed much interest in the production of text books describing how the various methods of evaluation (cost-benefit, multi-criteria, and so on) can best be applied according to the different types of decision concerned (minor projects, large-scale projects, operational projects, etc.). Three specific cases were mentioned:

- COBA, used for the evaluation of highway infrastructures in the United Kingdom;
- the rules drawn up by the German Government on some aspects of cost-benefit analysis; and
- the very extensive work carried out in the Netherlands by the "Committee for the Development of Policy Analysis".

Similar interest was shown in the production of books on teaching and applying evaluation methods with concrete illustrations. Works of this kind would be a great help in training officials and others involved in decision-making, and thus make it easier to establish two-way consultation with the experts.

It should not be forgotten, however, in this quest for a codification of methods, that it may be dangerous to use these well-defined techniques at different levels if the same criteria are not used. If different bodies have to give their views, it is highly probable that the assessment criteria would be different too, even if the evaluation technique were identical and completely codified; there would be grave risk of inconsistency in the findings. This is a further opportunity for underlining the need to differentiate according to the type of project.

- Where decisions in a completely discrete field (transport operation measures, for instance) and with clearly delimited implications (having a purely local impact, for example) are concerned, there is no difficulty in using evaluation techniques which are defined exactly and codified in advance, since there is no serious risk of incoherence.
- For projects having very wide-ranging implications (i.e., affecting the community at large), on the other hand, incoherence may arise in evaluations if bodies operating at

different levels are involved in decision-making. This must be prevented and it is of particular importance that no conflict should arise between policy at national and lower levels. A well-defined criteria structure should therefore be strictly adhered to and coherence established between the various levels of decision. Quite clearly, this requirement can only be met if there is general concertation among all the decision-makers based on a full exchange of information. There is no other way of ensuring that the various evaluation methodologies and the policies evolved from them are acceptable.

ii) Information on results

To change politicians' and public opinion's current mistrustful attitude towards scientific evaluation procedures, it is undoubtedly important that the experts should explain the methods applied as clearly as possible; but above all it is essential for the presentation of findings to be both precise and tailored to the needs of those who will have to take the decisions, or bear their consequences. In this connection, the Round Table considered that special stress should be laid on the following points:

- Language used - The main point to emerge here was the need for a language common to both analyst and decision-maker. This means that the decision-maker has to have some basic knowledge of technical terms and that the analyst must take into account the kind of things the decision-maker is thinking about. There is a serious risk of the language used by the analyst becoming too esoteric, so it ought to be kept within the comprehension of the majority. Numerical data, for instance, are often easier to grasp when expressed in concrete terms (say, numbers of homes, or hospitals) rather than in millions of monetary units. Information of this kind, at strategic points in reports, undoubtedly make them easier to understand because of the comparisons they permit but, at the same time, there are certain dangers in carrying the use of concrete rather than monetary measures too far since the inclusion of a large number of dissimilar statistics could make reports much more complicated to read.
- Breakdowns - Whatever methodologies are used, the conclusions drawn from evaluations should be analysed by region, kind of effect, categories of population and so on. Setting out the implications of a decision in as much detail and as fully as possible is undoubtedly the most effective way of forestalling reactions from politicians and pressure groups when the project is actually being implemented.

- Honesty in the presentation of results - Analysts put their credibility at great risk if they use excessive mathematical calculation as a way of covering up certain legitimate doubts or uncertainties in their findings. Means need to be provided of informing politicians of the precise quality of the data and the analysis and special care should be taken for the degree of uncertainty to be taken into account, because the effects of a decision can generally be forecast only within a certain degree of probability. There is no way of concealing from the politician all the possible variants which may occur in terms of the effects of a decision. At the very least, therefore, the expected effects of a project should be presented, not in a single table, but in several, so that the different scenarios which may result from a decision can be constructed. However, the production of a table showing the effects of a decision, but ascribing them their probabilities of occurrence is definitely the most effective information technique here.

More generally, it is most important to present the various alternatives to decision-makers and to public opinion in very clear fashion. Whatever the method of evaluation chosen, it is necessary to show - using algorithms to illustrate the alternatives and sensitivity tests - how well the options examined stand up to fluctuations in various environmental features or weighting factors likely to affect the evaluation. When submitting their reports analysts should, therefore, lay more stress than hitherto on the criterion of resistance to environmental hazards: that is one of the most telling considerations for decision-makers, who will very often prefer, not the best solution, but the most unshakable and least variable one, in other words the solution in which unwelcome surprises are the least likely. In the same way, since there are many different evaluation procedures and their results often differ, the concern to offer as truthful information as possible to the decision-maker should lead analysts to test the resistance of the various solutions to the methods of assessment employed. This, again, is particularly instructive for the politician. Thus it is only by conscientiously producing this kind of information that scientific evaluation methods can make an effective contribution to political decision-making. Nevertheless, there is no escaping the fact that, in view of the labour and cost of the analysis involved, it seems that the stability criterion must, unfortunately, be reserved in practice for major projects.

- Announcement of results to the public - Experts should be prepared - and allowed - to present the findings of their

inquiries to the public by all available means, including audio-visual mass media; in particular, it is important that they should take part in any ensuing discussion and debate, armed with all the information in their possession. But in many countries there are obstacles to dealing with public opinion in this way because of the existence of restrictions on the contacts which experts or officials may have with the media or with parties affected by a proposed decision.

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In addition to the fullest possible dissemination of information, particularly stressed by the Round Table, the following should also be noted as essential condition for establishing effective consultation leading to objection-proof appraisal procedures:

- The need for it to be easy for the analyst to know who the decision-maker is. As a rule, several bodies all have decision-making responsibility, each of them having partial authority. The Ministry of Finance is always involved. The expert responsible for the evaluation should, therefore, be enabled to identify the decision-makers concerned in a project clearly, so as to involve them as required in the relevant process of analysis and consultation.
- Acceptance of the "rules of the game" by all concerned. Analysts and decision-makers should all be in agreement about the significance of the evaluation and their respective rôles. "It is particularly necessary that the decision-maker should agree that his preferences and his pattern of evaluation should be defined; it would be extremely irksome for the decision-maker to insist on an 'objective' evaluation excluding any participation from him."(1)

Failing a system of consultation which meets these various requirements and operates in accordance with a procedure such as the Round Table defined, there is a risk that conflicts between analysts and decision-makers would become trials of strength and never take any other form. If so, it is highly probable that behaviour on both sides would be biased: in their anxiety to avoid disputes, each would be tempted to adopt an attitude which could well mean that the information available to them would be incorrect to the inevitable detriment of the evaluation process.

If the conditions for effectiveness described above - and they apply to the decision-maker as much as to the analyst - are not met, evaluation procedures are likely to result in the analyst taking the

(1) X. GODARD op. cit.

place of the decision-maker; the politician is bound to react to this threat of an increase in the expert's de facto power by rejecting all forms of scientific evaluation process. Scientific technocracy and pure political intuition form two extremes which can only be avoided by introducing consultation and the exchange of information on as broad and continuous a basis as possible.

CONCLUSION

In view of the scepticism which scientific methods of appraisal, such as cost-benefit analysis or multi-criteria procedures, arouse in politicians, bearing in mind the problems involved in taking intangible factors into account, and considering the difficulties in the way of determining collective preferences and weightings in evaluation, the Round Table laid emphasis, not so much on questions of analysis methodologies and techniques as on the paramount importance of defining a consultation procedure which ensures the participation of everyone concerned and the exchange of information among experts, decision-makers, public opinion and so on. In so doing, it took the same view as that of R. Frisch in the slightly different context of economic policy: "I am increasingly led to think that effective organisation of the co-operation between political authorities and technical economists necessary for reliably determining the (state) preference function is one of the most important aspects, if not the most important, of macro-economic planning".(1)

Ultimately, in any case, what emerges from the Round Table is not so much the conflict between different analysis methods as their complementarity and the specificity of their fields of application (depending on the scale of the problem, quality of data, etc.). As one researcher(2) recently concluded: basically, in multi-criteria analysis, "the part played by the market [appears to be] essential, the conventional market having to be replaced in part by other forms of market, the features of which have to be determined primarily as a function of the structure of the power of decision". Furthermore, a careful study of multi-criteria approaches shows that "gradualness in establishing the pattern of evaluation is another of the main features" of this kind of evaluation. "The basic incompatibility [of multi-criteria techniques] with cost-benefit analysis is certainly as attributable to these two features as to the one-

(1) R. FRISCH: "Numerical determination of a quadratic preference function for use in macro-economic models". *Giornale degli Economisti e annali di Economia*. 1961. Quoted by G. TERNY in: "D'une rationalisation des décisions économiques de l'Etat à la fonction de préférence étatique. *Analyse et Prévision*. July - August 1970.

(2) X. GODARD op. cit.

dimensional or multi-dimensional nature of the analysis." To the extent that in these two respects "there is a clear tendency for cost-benefit analysis to evolve, it may be assumed that the convergence that has already begun between these two kinds of analysis may well be confirmed in time to come".

At present, government decision-making is dominated by the problem of the limitation of resources; the Round Table was therefore at pains, quite apart from disagreements about methods, to emphasize the need to incorporate information sequentially in evaluation processes. Information is expensive, and it is futile to construct models which are too costly to use. No item of information should be added unless its marginal utility exceeds its cost.

One of the most important and critical problems currently presented by the use of scientific methods of evaluation is undoubtedly that of the interaction between the reliability and quality of data. In some cases the result is so clear that near-certainty can be achieved in the evaluation with very simple methods and virtually no data. At the other extreme, a project may have such wide repercussions, and its potential gains or losses be so great, that the availability of extensive data and the completion of in-depth analysis is essential. Now, it often happens that this relationship between certainty and the volume of work required to achieve it is not clear at the outset. This presents analysts - especially those working on a fixed, pre-determined budget - with an awkward problem of balance between the various stages of the work (data collection, forecasting, development of alternatives, short-listing alternatives, final analysis and conclusions). A useful way of overcoming this difficulty and minimising the cost of analysis would seem to be to set up, at the same time as general consultation is organised, a sequential analysis procedure in which, at different stages, definite decisions can be taken when the data are clearcut and in-depth studies can be launched when they are not.

SUMMARY

This Round Table more particularly considered problems concerning the practical application of methods such as cost-benefit analyses to help the political decision-making process. The discussion was not focussed on methodology as such.

Growing government intervention, limited financial resources, sharper conflicts and the increasing attraction exerted by extreme solutions, all showed it was essential to determine decision-making procedures which would focus discussion on the facts, limit the analyses to reasonable proportions and convince the more extremist groups that they could not be right.

1. Difficulties encountered in the decision-making process

a) Inadequate data

Here, attention must be drawn to the following points:

- the scarcity of basic data due to the inadequacy of practical tests which is itself bound up with lack of support from public authorities;
- the planning "crisis" as a most enlightening development;
- inadequate behavioural research and the suspicious attitude toward transport market research.

b) The problem of intangibles

Correct evaluation requires something more than conventional economic data; intangibles must be taken into account but their evaluation raises many problems.

- Research on intangibles is generally inadequate because of the lack of support from public authorities.
- Analysis of previous decisions brings no real solution to this problem. It is disappointing and calls for much circumspection because evaluation patterns do not always stay the same.
- When evaluating intangibles, one must not be over-ambitious. As a general rule, it does not seem essential to measure them in terms of money alone; it is usually enough, by means of a consultation procedure, to ask political decision-makers to specify the relative "social" values of intangibles.

c) Preference functions

Here, attention was drawn to the following:

- the difficulties of moving from individual to collective preferences;
- the mistakes made in the past when all individual preferences were regarded as being similar;
- conflicts in the theory of analysis, as shown by the impossibility of reaching agreement on a welfare function and on the determination of weighting coefficients (based on prices or on politicians' scales of values). Incidentally, this conflict also has a bearing on the present economic crisis.

d) Choice of methods

The arguments in favour of each method - cost-benefit analysis, multi-criteria analysis, etc. - are many and it does not seem possible at this juncture to show any clear preference in this respect. However, closer investigation does show that the various methods are not

in competition with each other, they are complementary and, basically, rather similar. Incidentally, it would be most useful to apply sensitivity tests for various solutions to various methods.

2. Requirements for project appraisal procedures to be effective

a) A wide and clearly determined field of analysis

1. Distinctions must be made between:

- problems due to the introduction of a new element in the system and those due to the management of that system; every project appraisal procedure must pay due regard to these two aspects;
- major one-off projects where the decision-maker needs a great deal of data as distinct from repetitive projects where the political decision-maker mainly wants a coherent frame of reference.

2. A wider field of analysis:

- analysis must not be limited to appraisal of the transport sector alone; every option must be analysed;
- due regard must be paid to all the factors that the economist regards as extraneous, the income re-distribution effects and the accessibility implications;
- no project appraisal procedure should overlook long-term effects.

b) Analysis based on concertation and information

1. Procedure based on concertation:

- This must be comprehensive. There must never be any lack of co-ordination between the analyst, the administrative services concerned and the final decision-maker. Concertation with public opinion is also essential, but a referendum is doubtless a too cumbersome procedure. The use of aids to decision-making consequently implies elaborate arrangements for concertation.
- Such concertation must be lasting. The period preceding the implementation of any project appraisal is most important: it is in consultation with the decision-maker that the fullest possible range of options must be drawn up. Only in this way can the problem of evaluation of intangibles be solved. To ensure that the analysis is not unnecessarily cumbersome, information should be integrated gradually.

2. Proper information

This should cover:

- the methods adopted: it is important to show clearly how the options to be evaluated were selected. A great interest was shown in the production of textbooks explaining the application of methods for helping the decision-making process to different kinds of decision.
- the findings: the language used by the experts is of great importance; it must be easily intelligible. The submission of findings, in fairly disaggregated form, should be as frank as possible and no uncertainties should be concealed. It also seems essential to test the sensitivity of the various options to the variations of the different factors. Furthermore, the experts and administrative services concerned should be able, and willing, to submit their findings to public opinion.

LIST OF PARTICIPANTS

Professor J. PAELINCK
Director
Nederlands Economisch Instituut
Burgemeester Oudlaan 50
ROTTERDAM 3016 (Netherlands) Chairman

Mr M.J. FROST
METRA Consulting Group Limited
23 Lower Belgrave Street
LONDON SW1W 0NS (United Kingdom) Rapporteur

Professor Dr. G. BLAUWENS
Universiteit Antwerpen
U.F.S.I.A.
Prinsstraat 13
2000 ANTWERP (Belgium)

Professor P. BOHM
Department of Economics
Stockholms Universitet
Fiskartorpsvägen 160 A
Fack
104 05 STOCKHOLM 50 (Sweden)

Professor Dr. rer. pol. R. FUNCK
Institut für Wirtschaftspolitik
und Wirtschaftsforschung der
Unuversität Karlsruhe (TH)
Kollegium am Schloss, Bau IV
Postfach 6380
75 KARLSRUHE 1 (Germany)

Mr X. GODARD
Economist
Division Transports Urbains
Institut de Recherche des Transports (IRT)
2, Avenue du Général Malleret-Joinville
B.P. 28
94110 ARCUEIL (France)

Professor K.M. GWILLIAM
Director
Institute for Transport Studies
The University of Leeds
LEEDS LS2 9JT (United Kingdom)

Dr. P. HENSELER
Technische Universität Wien
Institut für Finanzwissenschaften und
Infrastrukturpolitik
Karlgasse 11
1040 VIENNA (Austria)

Mr U. JACOBSEN
Economic Adviser
Ministry of Public Works
Frederiksholms Kanal 27
1220 COPENHAGEN K (Denmark)

Professor Inc. Stab. LA SAPONARA
Istituto Universitario Navale
Via Acton 38
NAPLES (Italy)

Mr T. MASNOU
Ingénieur des Ponts & Chaussées
Chef du Département Etudes de Transport
Service des Affaires Economiques
et Internationales (SAEI)
55-57, rue Brillat Savarin
75013 PARIS (France)

Dr. rer. pol. J. NIKLAS
Deutsches Institut für Wirtschaftsforschung
(Institut für Konjunkturforschung)
Königin-Luise-Strasse 5
1000 BERLIN 33 (Dahlem) (Germany)

Mr K. ØSTMOE
Research Economist
Transportøkonomisk Institut
Stasjonsvn 4
OSLO 3 (Norway)

Professor Dr. J.A. PLAZA
Ingénieur en Chef
Division de Planification et
Projets des Routes
Ministerio de Obras Publicas
3.a Jefatura Regional de Carreteras
Botica Vieja, S/N
Boite postale 1492
BILBAO-14 (Spain)

Professor J.B. POLAK
State University
Faculteit der Economische
Wetenschappen
Hoogbouw W.S.N.
Universiteitscomplex Paddepoel
Postbus 800
GRONINGEN (Netherlands)

Mr Tim J. POWELL
Economist
Coopers & Lybrand Associates Ltd.
Shelley House
3 Noble Street
LONDON EC2V 7DQ (United Kingdom)

Mr REY
Administrateur Principal
Direction Générale des Transports
Division "Infrastructure et Equipement"
Commission des Communautés Européennes
Rue de la Loi, 120
1040 BRUSSELS (Belgium)

Mr E. SIIVONEN
Economist, Special Researcher
Ministry of Finance
Planning Secretariat
Pietarinkatu 6
00140 HELSINKI 14 (Finland)

Dr. rer. pol. M. TIETZEL
Assistant
University of Bonn
Institut für Industrie und
Verkehrspolitik
Adenauerallee 24-26
53 BONN (Germany)

Mr Ch. TURNER
Nathaniel Lichfield and Partners
Planning Development Transportation and
Economic Consultants
The Old Brewery
Brewery Mews
Hampstead
LONDON (United Kingdom)

Mr J. ZIGHERA
U.E.R. des Sciences Economiques
Université de Paris X-Nanterre
200, Avenue de la République
92001 NANTERRE Cedex (France)

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