

## DEMAND FOR TRANSPORT RESEARCH

by

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## 1. INTRODUCTION

Transport and applied economic and technological research share the inherent characteristic of being means rather than ends. It might be expected that the managers of transport research would be particularly cognisant of this basic aspect of their work, and that it would be reflected in the research procedures and administrative practices that characterise transport research activities.

However, it can readily be contended that the business of transport research<sup>(1)</sup> is frequently unrelated to practical or political reality. Further, transport research sometimes appears to have become an end in itself and is consequently failing, in a pragmatic sense, to meet the needs of the community it was established to serve. This community is represented, in the first instance, by the policy-makers. Transport research as a service to the public at large is generally indirect, since the primary aim of such research is to assist policy-makers in their task of formulating appropriate strategies for development of the transport system. This paper is largely concerned with the research-policy nexus and its implications for achieving effective research. Some effort is made to demonstrate that researchers sometimes exhibit little concern for the relevance of their product. Certainly, the level of concern shown is less than that which the same researchers would expect others in the transport field to show when matching their services to public demands.

To indicate the resources allocated to transport research, Table 1 shows government expenditure on research and development (R&D) by several countries. In this sample of 15 OECD countries, government expenditure on transport and telecommunication<sup>(2)</sup> R&D totals over \$1.4 billion US. However these statistics by no means indicate the extent of expenditure on activities which would generally be accepted as part of research. The restrictive nature of the definition of R&D employed by the OECD results in the exclusion of expenditure on many activities which are associated with transport research. These include:

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- (1) Throughout this paper, the term 'transport research' refers to research in support of governmental policy development related to transport at a strategic level.
  - (2) It is not generally possible to differentiate between research and development in the transport and telecommunications fields, since they are reported in aggregate.

## DEMAND FOR TRANSPORT RESEARCH

by: W.P. Egan

- . feasibility studies;
- . policy-related studies;
- . data collection; and
- . testing and demonstrations.

In a recent study performed by the Bureau of Transport Economics (BTE), it was shown that government expenditure on these related activities in the transport field in Australia was almost five times the expenditure on transport R&D of the type recorded in Table 1 (BTE, 1982). Expenditure associated with transport research thus represents a significant part of nations' wealth. This leads to the vital question of whether such expenditure is providing value for money.

TABLE 1 - EXPENDITURE ON GOVERNMENT R&D - 1979<sup>(a)</sup>  
(US \$ million)

Country	Transport and tele- communication R&D	Total R&D
Australia	8.5 (0.007)	469.9 (0.390)
Belgium	9.0 (0.006)	642.4 (0.460)
Canada	38.3 (0.017)	981.2 (0.427)
Denmark	2.5 (0.004)	315.2 (0.479)
Finland	3.4 (0.008)	223.7 (0.538)
France	183.6 (0.032)	6223.4 (1.086)
Germany	185.8 (0.024)	8641.3 (1.136)
Italy	5.9 (0.002)	1265.1 (0.390)
Japan	70.8 (0.007)	5076.4 (0.509)
Netherlands	24.4 (0.016)	1448.2 (0.923)
New Zealand	2.0 (0.009)	155.8 (0.728)
Norway	19.9 (0.042)	422.0 (0.896)
Sweden	39.0 (0.036)	1270.2 (1.187)
United Kingdom	31.8 (0.008)	5203.9 (1.278)
United States	799.0 (0.034)	29040.0 (1.225)
TOTAL	1423.9 (0.022)	61378.7 (0.941)

(a) R&D expenditure as a percentage of GDP is given in parentheses.

Sources: OECD (1981), IMF (1982).

## 2. EFFECTIVENESS OF TRANSPORT RESEARCH

An evaluation of transport research is required to approach an answer to the question of the value of research expenditure. While a variety of evaluation techniques are part of the transport researcher's standard armory, these techniques are rarely (if ever) applied to the researcher's own activities. As an economic service, transport research can be evaluated in a number of ways, and the selection of evaluation methodology to be used should reflect the goals of the particular program. Examples of evaluation approach include:

- . Benefit-cost studies, at a variety of levels of generality, which determine the overall economic surplus associated with programs. This approach focuses on economic efficiency and is not directly concerned with distributional aspects.

Incidence analysis, in which welfare and equity considerations predominate through the identification of the recipients of benefit and cost flows.

Direct measures of research output in relation to resources devoted to the research.

One of the problems encountered in applying benefit-cost analysis to transport research concerns the measurement of benefits. This is particularly the case where a proposed course of action is found to be ineffective. Not only are the potential net costs of that proposed action avoided, which is a benefit that might be accredited to the research, but there are also the net benefits of an alternative course of action which may be adopted in place of the ineffective proposal. In addition, it is difficult in many cases to determine the benefits which should be accredited to the research itself, since it is rarely clear that a particular piece of research was the sole cause of some action (or inaction). Nevertheless, one consequence of the fact that transport decisions frequently involve large amounts of money is that attempts to evaluate transport research on a benefit-cost basis can be quite gratifying. As an example, implementation of the findings of a recent relatively small study performed in the BTE could yield a benefit-cost ratio for the study itself of the order of 100:1. However, even if the results of a particular transport research study are not implemented, the 'benefits' of the study are not necessarily zero since presumably the study may have contributed to the decision-making process in some way.

As well as the magnitudes of benefit and cost flows, their incidence may also be considered in an evaluation of a particular piece of transport research. In identifying the recipients of benefits of any research, the research organisation itself should not be overlooked. Some general credit and enhanced prestige may result from well-performed research. Although this should only be a by-product of the research, cases in which it is considered more directly are discussed later in this paper.

Other possible measures of transport research effectiveness have some commonality with those often applied to R&D in science. These include the number of reports, citations and so on, per unit of expenditure on research. However, they are in general fairly unsatisfactory because their measures of output are rather superficial.

UNESCO recently undertook a comprehensive investigation into scientific R&D effectiveness, which emphasised the multi-dimensionality of R&D effectiveness and hence the lack of validity in using the more superficial measures of output to evaluate research. One of the major conclusions from this investigation was that the competence and personality of the unit head, together with the satisfaction of the unit members with the quality and sufficiency of its human resources, were most important influences on the effectiveness of R&D units. These exceeded the importance of the financial resources available to such units (UNESCO, 1979).

While this conclusion refers to scientific R&D, it is interesting to conjecture on its application to transport research. It identifies a possible source of variation in research effectiveness as reflected in levels of primary output, such as the number of reports and so on. Effectiveness of research in terms of its impact on policy, however, is a step forward from the performance of R&D. This is not to say that the UNESCO conclusion may not be equally applicable to policy-related research; it certainly should give some food for thought to the executives of transport research agencies.

The issues that have been discussed are applicable to transport research of a variety of types and at a variety of levels. They are essentially concerned with the researcher applying his techniques to his own research activities. In this paper the emphasis is on transport research at a strategic level, which is aimed at influencing administrative and management policy. It is here that some serious consideration should be given to evaluating the effectiveness and efficiency of research efforts. In this regard, Christopher Willoughby at the 1980 World Conference on Transport Research, called for research on the socio-political process of introducing change. He pointed out that the provision of information to assist decision making is only part of effective research, which in addition should include considerations of the effects of a variety of constraints on the research results, and also explore incremental steps in achieving the recommended positions (Willoughby 1980).

More recently, the retiring Chairman of the US Transport Research Board, Thomas Larson, commented that research has often not been attuned to policy and that there is a need to examine the status of research from a more strategic perspective (Larson 1982). He also noted that transport research funding in the USA has declined significantly (in real terms) over the past eight years, and delivered a clear message that further cuts could result should transport research not be relevant to current policy and future needs.

There are similarities in the relationship between research and the policy-makers, and the relationship between policy and the public. One can consider policy-makers to be 'consumers' of research, just as the public are 'consumers' of policies(1). This consumerist paradigm leads to the observation that the researchers' criticisms of policies in the public domain can also be applied, in some cases, to their own research in the policy domain. For every unwanted or irrelevant policy, there is unwanted or irrelevant research. Policies that ignore consumer behaviour impacts in other areas are mirrored by research recommendations that fail to appreciate impacts in associated policy areas. Just as there are restrictive policies, there is restrictive research in which a preferred option is advocated to the exclusion of options which may well have merit in the policy-makers' 'second best' environment. As an example, Australia has a domestic aviation policy which restricts air operations on major domestic routes to two airlines, one publicly and one privately owned. This policy has evolved since the early 1950s, and over this period it has become a *cause celebre* of Australian transport research. In the main, this research (particularly from independent agencies)(2) has advocated some dismantling of the 'two airline' policy, and there has been very little research on improving the effectiveness of the current policy, or on incremental adjustments to it.

### 3. RESEARCH ORGANISATIONAL STRUCTURES

The perspective from which any examination of transport research should be made is dependent on the nature of the associated policy environment. Transport research is performed in a number of different types of organisations, with a range of relationships with policy agencies. Common types of organisations in which transport research is carried out are:

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- (1) There is a distinction which can be made between the two situations, however. Policy-makers can be considered to be voluntary 'consumers', though the public cannot be regarded as having a similar advantage. Nevertheless, some might consider that the substitution of the word 'victim' for 'consumer' in both cases would not be inappropriate.
  - (2) Discussed in more detail below.

- . operating agencies;
- . regulatory agencies;
- . agencies with strategic policy responsibility;
- . government research institutions;
- . private research institutions; and
- . universities and colleges.

Within these agency types, there are different organisational structures varying from bureaucratic to collegial (Lehman and Waters, 1979). The term 'bureaucratic' describes research bodies whose research priorities are shaped mainly by a central administration, whereas collegial agencies are characterised by principal investigators having the responsibility for designing and running research projects, as well as for soliciting their own research monies and often hiring their own staff. The combination of institutional types and organisational structures is associated with variations in the nature of transport research and its effectiveness in different contexts. For example, in the USA Lehman and Waters (1979) found that research institutes with bureaucratic control had a greater impact on policy. It is not surprising that an association between effectiveness in influencing policy and bureaucratic control structure was found to exist. The bodies that determine policy are themselves generally bureaucratic (in the sense of being hierarchical and formalised), and it is quite likely that the similarity of structure could enhance communication between the policy and research bodies. Enhanced communications lead not only to a clearer understanding by the researchers of the policy-makers' needs, but may also involve the researcher 'following through' by providing subsequent informal advice. In addition, some research agencies are administratively linked to policy organisations and a substantial part of their efforts may derive from this association, with the resultant likelihood of policy influence.

Another characteristic investigated by Lehman and Waters (1979) was staff mobility between research centres and federal agencies. It was found that bureaucratic institutes were far more likely to use the 'revolving door' than collegial institutes. Here again, improvements in communication and understanding through this process are likely to benefit the effectiveness of the bureaucratic institutes.

On the other hand, collegial institutes might be expected to have strengths in different areas to those which directly influence policy. They might, for example, be suited to the development and application of new techniques. While a bureaucratic institute might be structured to deal effectively with a small number of policy-making agencies, a collegial institute could specialise in a small number of techniques, and apply them over a large range of issues. In this way, the policy impact of collegial institutes is often once-removed, in that such organisations might be employed by bureaucratic institutes for their particular specialities which would form part of a larger, policy-related research project.

Different organisational aims are reflected by different views of research 'professionalism'. In another address to the 1980 Conference, Marvin Manheim from MIT, an organisation probably close to the collegial model, asked:

Do we accept a problem definition as given to us by our client (a minister or an agency?) Or, do we have views about problem definitions which are strongly-enough held that we consider 'unprofessional' a study or analysis which fails to define the problem consistent with these views? (Manheim, 1980).

The latter approach was implicitly endorsed in Manheim's paper.

This view of professionalism of the collegial research contrasts with the comments of Willoughby (1980) quoted above, which called on the researcher to recognise policy constraints. The latter view was from the perspective of the World Bank, a far more bureaucratic research organisation. The two views are not incompatible, and in fact they may be considered to be complementary in some respects, as is demonstrated later in this paper.

The effects of organisational structure on aspects of the research-policy interaction are part of a broader range of influences associated with administrative arrangements. One of the most important characteristics of these arrangements is the degree of independence of the research agency from the policy agencies it serves. There are research organisations within policy agencies, and at the other end of the spectrum are various consultant and university groups. Semi-autonomous government research bodies and the established private research foundations make up the middle ground.

In broad terms there is some correlation between the bureaucratic-collegial continuum and the degree of independence of the research agencies, with the more collegial organisations tending to be more independent (in an administrative sense) of policy agencies. The degree of administrative independence primarily affects the nature of the research, and the range of projects undertaken, whereas the organisational structure can influence the effectiveness of various types of research and hence the establishment of specialities.

A distinction between different research roles emerges from the above view of the influence of research administration and organisation. 'Controversial' research<sup>(1)</sup> provides an illustration of this difference. In advocating an 'enlightenment model of research', Weiss (1977) investigated the potential usefulness of policy research and found decision-makers believe that:

... it is a good thing to have controversial research, challenging research, research that makes them rethink comfortable assumptions<sup>(2)</sup>.

Such controversial research may not sit very comfortably in a bureaucratic research environment, particularly if the agency is attached to a government department and the research is of a substantial nature. There are two major reasons for this. Firstly, research reports from government agencies are frequently perceived by the public to represent, in some way, an official government view. This can cause schisms between policy and research areas with damaging consequences for future research programs. Secondly, limited resources and a high demand for more mainstream research combine to make the justification of any substantial commitment to controversial research difficult to sustain.

This is not to deny the need for controversial research, indeed 'radical'<sup>(3)</sup> research, it merely suggests that bureaucratic agencies directly associated

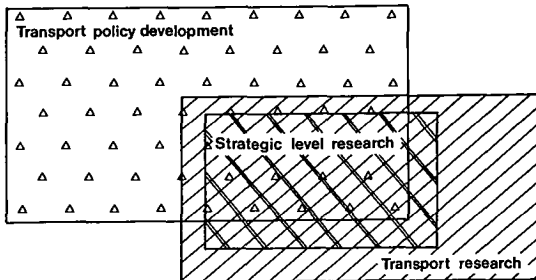
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- (1) Research outside of the mainstream, frequently producing results which require non-marginal policy changes.
  - (2) This may be news to some of those engaged in transport policy research! However it should be noted that the statement is in reference to opinions of potential usefulness which may or may not coincide with the actual contribution of such research over a range of different policy areas.
  - (3) Research which challenges society's institutions.

with governments are designed (or perhaps have evolved) largely for a different role. It is in this area of research that the more independent agencies, often with a more collegial structure, have an important role. The collegial structure facilitates the assembly of *ad hoc*, specialised research groups. This situation is recognised by bureaucratic research organisations and controversial research is often contracted out to consultants. In this way, government research agencies can distance themselves from controversial research and if necessary can 'disown' it. The distinction between the roles of independent research organisations and those with a more direct policy association was illustrated previously in discussing the indirect influence on policy of research agencies which have developed some speciality. These would tend to be independent agencies, frequently collegially structured.

A similar consideration of the different organisational roles leads to reconciliation of the two seemingly conflicting views of professionalism regarding the neglect versus the recognition of policy constraints on research quoted earlier in this paper.

The relationships of transport research in general and strategic-level research in particular to transport policy development can be illustrated diagrammatically as in Figure 1. The activity of policy development includes the undertaking of research to support such development. The overlap of the two activity sets (transport policy development and transport research) in Figure 1 illustrates this situation. A further classification of transport research into strategic-level research is also illustrated. As indicated in Figure 1, the majority of this research is undertaken in direct support of policy development(1). Figure 1 indicates that a significant amount of transport research is not policy-related and, further, that even some strategic-level transport research is in this category. This component of strategic-level research comprises some of the types of research noted previously in this paper as being 'inappropriate' in one way or another to the work of the policy agencies.

FIGURE 1 - RELATIONSHIPS BETWEEN RESEARCH AND POLICY-DEVELOPMENT ACTIVITIES



(1) This does not necessarily mean that it is actually undertaken by policy agencies themselves. The question of the characteristics of the agencies carrying out the research is addressed subsequently.

## DEMAND FOR TRANSPORT RESEARCH

by: W.P. Egan

Figure 2 provides a diagrammatic representation of the characteristics of organisations performing transport research. Three characteristics are illustrated:

- . the organisational structure in terms of the bureaucratic-collegial continuum;
- . the degree of relevance to policy development of the research carried out by the organisation; and
- . the administrative dependence of the organisation on a policy agency.

Transport research organisations can be mapped into the enclosed space shown in Figure 2. For example, the figure shows that research organisations carrying out work with little policy relevance are not usually administratively involved with policy-development agencies to any great extent. This independence is emphasised in the research organisations structured on collegial lines.

FIGURE 2 - CHARACTERISTICS OF RESEARCH AGENCIES

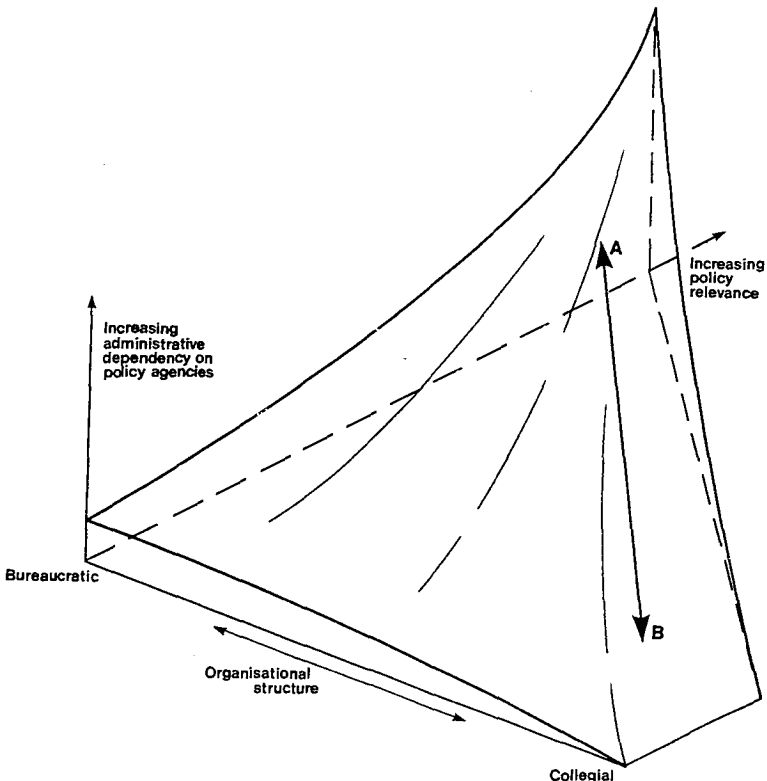




Figure 2 also illustrates the characteristic that collegial institutions do not carry out policy-relevant work to the same extent as bureaucratically structured organisations, and also that there is more scope for the latter to be administratively dependent on the agencies responsible for policy development. One can consider the line AB on Figure 2 to represent the direction indicating the shift of the nature of transport research from the constrained, highly policy-dependent and policy-relevant research at one extreme, to the unconstrained, often controversial research at the other. The faults of the former are well-known. This paper suggests that the faults with the latter also deserve attention.

#### 4. RESEARCH RELEVANCE

Directly or indirectly the research requirement is always determined in a policy environment. At a local level this could involve changes to parking regulations in part of a city, or alterations to a bus timetable. At a regional level, examples might include closure of rail branch lines, or road network changes, while at a national level vehicle design regulations, national road funding programs and public transport subsidy assistance might be investigated. Overseas shipping questions or changes to bilateral air agreements have an international context.

Clearly the research requirement varies in nature, scope and complexity. There is, however, a common denominator. To be effective, research must produce results which can be implemented. The extension of this principle is that the researcher should be aware of the policy issues which influenced the development of the research requirement. Where this has not been the case, and the research has not been effective, it is all too easy for the policy-makers to accuse the researchers of not being 'relevant' while failing to acknowledge that their omission of implicit policy constraints in the original problem definition influenced the research direction. Research organisations should be aware of these considerations and take them into account in preliminary planning and subsequent project development. However, there are undoubtedly research organisations associated with some policy agencies which do not contribute in a decision-critical way to their work of policy development. These agencies tend to sponsor research largely in an attempt to justify unpopular decisions. 'Relevance' in this context is a fairly cynical term.

In a discussion of the concept of 'relevance' in policy research, Arad, Bacchus, Gonzales and Starr (1975) state that:

the only criterion of relevance which seems to enjoy general acceptance is the degree of utility as it is measured by policy-makers.

However, they go on to say that:

equating relevance with the more immediate needs and interests of policy-makers falls short of squarely facing the full issues involved.

In other words, there must be some anticipation of possible future problems, and a component of the research effort should be concerned with establishing and maintaining a general research capability and preparedness. This covers a range of activities which include data base generation, training in new techniques, and communication with the transport community.

One of the difficulties that researchers encounter in attempting to meet policy needs is that these vary with the level of responsibility within a policy organisation. For example, the BTE was recently asked to prepare a framework for the development of a national aerodrome plan for Australia. In dealings with the policy agency involved, it became clear that the requirements of those who hoped to use the research results on a day-to-day basis were quite different to the requirements of those at a higher level

of responsibility. While this is not unexpected, reconciling these different types of requirements can often result in an expansion of the scope of the project and in turn can affect the timeliness of the research.

To be relevant, it is clear that research must:

- . be objective, at least in the sense that value judgements are clearly identified;
- . produce results which are capable of implementation;
- . address the critical issues and not become sidetracked by peripheral matters;
- . be timely - some decisions have to be made within a certain period and will be made with or without the benefit of any research results;
- . be 'solution-oriented', and describe the effects of different courses of action;
- . be based on sound methodology;
- . be presented coherently, bearing in mind the likely audience;
- . be targetted at the level of responsibility for the program or decision under review.

While the principles outlined above would be generally endorsed by most research organisations and individual researchers, in practice transport research does not always follow them. As noted previously, in the consumerist paradigm of research it is easy to preach dogma rather than address the issues in a second-best environment. This is exemplified by the researcher, when asked how a particular policy should be adjusted, saying 'throw it away, here is the latest gospel'. An almost act-of-faith commitment to the end result can cause the researcher to gloss over difficulties in its achievement, and a partisan advocacy can therefore replace objectivity.

Research can also become introspective without a practical policy context. This can lead to the development and monopolisation of a particular technique applied with little discrimination. At the 1980 Conference, Manheim warned of:

the professional hazards in the development and use of models - for example, the model in search of a problem, the advocacy of a particular model regardless of the situation, or the fact that each professional discipline has its own inherited wisdom as to what is an appropriate model (Manheim, 1980).

Examples of the application of a familiar rather than an appropriate methodology abound. Andersson (1971) describes an instance from Sweden which provides a very clear illustration of this problem. In Andersson's words: -

When we in Sweden were going to change from left-hand traffic to right-hand traffic, a special governmental office was created with the initials HTK. Among the responsibilities this office had was the information about the changing operation.

Six months before the changing day, the HTK office published a press release saying that "the Swedish people were not yet prepared". They drew that conclusion from a questionnaire the office had sent out, the results of which showed that it was obvious that very few people in Sweden knew the meaning of the letters HTK! The "researchers"

who did this "measurement" applied what they had learned in their previous occupation in advertising. They did indeed make a measurement - but they were not aware of what it was that they had measured. When you put out a product on a market, it should be of interest to find out how many people know the product or company name. But in this case the problem was to determine if people were prepared for the right-hand traffic, not if they were able to decode the letters HTK.

One would like to be consoled by the thought that such absurdities are rare. Unfortunately, they can be found rather frequently in various guises.

An almost proprietary interest in particular methodologies can turn the focus of research from the sponsor's requirements to the researcher's interests. The research changes from a means to improve policy to an end in itself - a change from applied research to a bogus purity. There are ample opportunities for this to occur:

the researcher is not only in the business of finding or sorting among Answers. He is inevitably involved also in finding or sorting among Questions (Rein & White, 1977).

The above-quoted example from Sweden is a case in point. In a slightly different field, a recent investigation of the differences between various econometric forecasts of the British economy indicated that the ideological orientation of the research groups affected the nature of their models, producing results consistent with their ideologies (Artis, 1982).

This introspection on the part of the researcher in terms of the techniques he employs can cause him to ignore the underlying rationale for his work. Inevitably, the result is a decline in the relevance of the research performed because the context of the work has become obscured.

## 5. CONCLUDING REMARKS

This paper has set out to explore the relationship between transport research and the various environments within which it exists. Particular attention has been focussed on the origins of demand for transport research, and on the relationship between those origins and the type of research in question. In this context, general aspects of the various levels of research were examined against the requirements and desires of the 'consumers' of the research - the policy-makers. This examination was extended to also cover the degree to which transport research (and particularly at the strategic level) recognises the constraints applying to many practical issues of concern to its consumers.

There are two strategies that researchers could adopt in pursuit of the (superficially conflicting) principles of relevance and professional integrity discussed previously. Firstly, problem definition should be formulated in researchable terms. To use the results of research effectively, the consumers of the research (in the sense discussed in this paper) need to be aware of the research limitations, and be aided in the formulation of their concerns in such a way as to maximise their benefit from the research. This also presents the researcher with the responsibility to ensure that these limitations are explicit and capable of being interpreted by the policy-maker.

Secondly, the researcher should be aware of the characteristics of the policy environment which may be affected by the adoption of his recommendations. If these recommendations involve substantial policy reorientations, then all the ramifications of such a change and the appropriate ways of its implementation require investigation.

The precursor of these strategies is effective communication between the researcher and the policy-maker. Communication on policy issues is an essential condition in ensuring both appropriate problem definition and an insight into possible implementation problems with the attendant additional research requirement. The establishment and maintenance of this communication is one of the most important challenges in transport research.

A central contention of this paper has been that some strategic-level transport research tends to focus too narrowly on one alternative to current policies without adequate recognition of other options. This problem could be mitigated if, in terms of the consumerist paradigm, researchers applied the same principles of consumer satisfaction to their own work as they advocate the policy-makers should apply in framing effective policy.

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