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IMPLEMENTATION ANALYSIS FOR TRANSPORT PROJECTS IN THE PUBLIC AND PRIVATE SECTORS

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Abstract:

The paper argues the case for the incorporation of Implementation Analysis in project evaluation. In the first half of the paper, four categories of implementation analysis are distinguished, and some differences between economic evaluation and implementation analysis are noted. In the second half of the paper, a case study is presented based on the rail transport of export coal to Port Kembla. A number of potential implementation problems which may occur with the introduction of heavy, high speed unit coal trains are identified, and reference is made to the price the community is likely to pay if these implementation problems are not overcome.

IMPLEMENTATION ANALYSIS

INTRODUCTION

Up until now there has been a tendency, in evaluating transport projects, to assume away implementation problems. The predicted costs and benefits are displayed in reports, but not the probability of achieving these impacts in practice. Yet few large transport projects are ever constructed inside their budget and time constraints.

Implementation planning is a very complicated process "which we understand very imperfectly" (Campbell and Geisler, 1969, p. 549), although in recent years the Rand Corporation has attempted to develop implementation models (Berman 1978 and Wolf 1978). The techniques of implementation planning which are most frequently applied in project management are network analysis techniques such as Program Evaluation and Review Technique (PERT), Critical Path Method (CPM) and system simulation models. These techniques tend to focus on the engineering construction events and activities, specifying the sequencing of tasks to be completed, the establishment of time and cost schedules, work breakdown structures and the identification of the critical path. However, often these forms of implementation planning neglect to identify and analyse foreseeable implementation bottlenecks created by human relations issues, industrial relations problems, the influence of pressure groups and political intervention, relationships between different levels of government and between government departments and other issues which could be intelligently anticipated.

The complex social, economic, environmental, political and administrative impacts of projects must be integrated and incorporated in any effective comprehensive implementation plan. This form of planning requires the skills of not only engineers and economists but also a multi-disciplinary team of social and environmental scientists. To date, most project planning in Australia has been fragmented with individual specialists being assigned responsibility for planning sub-components of large projects. Rarely are the plans of sub-project managers integrated together in one document which provides a masterplan for the implementation of the entire project and an implementation control system. By undertaking effective implementation analysis many implementation problems can be identified, predicted and analysed, and often preventative actions can be designed to reduce, avoid or eliminate the foreseen problems.

Many transport projects in Australia have run into problems of cost overruns, output shortfalls and benefit deferrment which could have been foreseen and predicted at the start of the project, or before the decision was made to go ahead with the project. Similarly, we can foresee

many problems with the transport of coal to the new coal loader at Port Kembla as from 1982. These potential problems are listed in the paper as an example of how to carry out implementation analysis. However, before proceeding to identify these problems, it may be useful to outline the nature of implementation analysis and to comment on its benefits.

IMPLEMENTATION ANALYSIS DEFINED

Implementation analysis can be defined as an analysis of the bureaucratic,institutional and human factors which can contribute to the achievement or non-achievement of policy/program/project objectives. Williams has described implementation analysis as follows: "In its most central form, an inquiry about implementation.....seeks to determine whether an organisation can bring together men and materials as a cohesive organizational unit and motivate them in such a way as to carry out organisations' stated objectives (1971, p. 144).

Implementation analysis seeks to identify those factors which are likely to lead to program failure or malfunction, in terms of cost containment, output achievement and effective delivery of the program to the intended target group. By systematic and detailed examination of the implementation process, it seeks to identify the underlying reasons for programs failing to reach their projected output levels, and for unanticipated increases in program costs. Issues of central importance in implementation analysis include:

1. Whether specific program objectives by which the program can be evaluated have been clearly identified and transmitted to all levels in the organization.

2. Whether adequate manpower and financial resources are available to carry out the program.

3. Whether program implementation planning has been oriented to provide information on possible bottlenecks, time delays, industrial disputes and other problems.

4. Whether staff understand the objectives of the program.

5. Whether steps have been taken to monitor and evaluate the progress and effectiveness of the program.

6. Whether the program is reaching the target group for which it is intended.

TYPES OF IMPLEMENTATION ANALYSIS

Four types of implementation analysis can be distinguished according to their timing in the overall program management cycle. Type 1 analysis can be carried out before a particular program is chosen as the most effective option under consideration. At this initial decision-making stage, implementation analysis may be used to model the implementation processes associated with alternative programs under consideration. Here the probability of successfully implementing alternative delivery systems can be assessed and made an input into the decision-making process. In the past many evaluation studies of alternative policy options or alternative programs have assumed that all options under consideration have an equal probability of being successfully implemented. However, experience has shown that some programs have a much higher probability of running into implementation problems (due to their particular nature) in comparison to other alternative options. Therefore, it is most desirable that in carrying out initial policy evaluation studies that the delivery systems and implementation processes of alternative programs are modelled to calculate the probability of successful implementation of the options under consideration. All too often analysts assume that the options under consideration have an equal probability of successful implementation. This distorts the ranking of alternatives as no account is taken of the probability that the expected benefits and costs associated with the options will in fact be achievable.

The second type of implementation analysis can be conducted after a project or program is chosen, but prior to the commencement of its operation. The purpose of this type of analysis (which is illustrated later in the paper) is to improve the implementation process by constructing a network of program activities and events from the start to the conclusion in order to identify critical paths and possible sources of cost over-run, bottlenecks and other implementation problems. This will normally involve the construction of a time schedule for the preparation, implementation and follow-up stages of the program/project. Also, flow charts may be used to show the relationships between activities and events of the program and agencies, departments and authorities responsible for implementation of the project, or indirectly related to the project/program. The implementation analysis at this stage should check on whether adequate indicators of achievement of objectives have been identified that relate to the operational objectives of the programs. Using techniques such as systems analysis, operations research, the critical path

method and program evaluation and review technique, analysts can check on a wide variety of implementation issues. For example, it is necessary to check whether financial and manpower resources will be available to carry out the program; whether staff are aware of the aims of the program and what measures have been taken to motivate staff to carry out the program. Also it is important to identify any industrial relations issues which may arise from the implementation of the program and to check on the expected impact of the program on special interest groups, who are likely to benefit from the program or to be adversely affected by it. Implementation analysis should check on the adequacy of the implementation monitoring process to see whether the right types of data will be regularly collected so that the progress of the program can be regularly monitored. Careful planning and analysis of the implementation processes at this stage of the program's management cycle may often lead to redesign and improvement of a program which reduces the likelihood of malfunction or failure.

The third type of implementation analysis can be carried out when a project or program is operational. The object of this analysis is to review the effectiveness of the program in terms of achieving its stated objectives. This involves comparing the actual outputs and costs of the program with the expected output and costs and identifying the underlying causes of the differences between the expected and actual impacts of the program or project. The function of this type of analysis is to improve the effectiveness and efficiency of the program implementation process. It is a monitoring and control process by which the program is modified and changed as a result of the implementation analysis.

The fourth type of implementation analysis can be conducted after the completion of a program or project. It is in fact an ex-post evaluation study of the implementation of a program or project. Most American studies fall into this category, and their aim is usually to identify why particular government programs have failed to achieve their objectives (LEVINE, 1972; PRESSMAN and WILDAVSKY, 1973). This usually involves a detailed analysis of the economic, political, social and environmental factors which have influenced the outcomes of the programs. The only real benefit of this type of study is that we may learn from experience and perhaps in designing new policies and programs avoid some of the costly mistakes that have been made in the past.

DIFFERENCES BETWEEN ECONOMIC PROGRAM EVALUATION STUDIES AND IMPLEMENTATION ANALYSIS

Many government programs and projects have been the subject of an economic evaluation study using the framework of cost/benefit analysis and cost/effectiveness analysis. Like implementation analysis, cost/benefit/effectiveness studies can be ex ante, ex post or carried out on an on-going program. The main differences between the normal cost/benefit/effectiveness aproach and implementation analysis are:

1. Cost/benefit/effectiveness studies focus on program inputs and outputs, whereas implementation analysis focuses on the effectiveness of the implementation process and the causes of implementation problems, which lead to the program malfunction or failure.

2. Cost/benefit/effectiveness studies attempt to measure all the economic impacts of a program and convert them to a single monetary index so that benefits and costs can be compared. Whereas implementation analysis is concerned with identifying human and institutional factors which are likely to have led to cost increases and bureaucratic, social and human factors which are likely to prevent the project from achieving its planned level of benefits or outputs. Implementation analysis is thus more concerned with the bureaucratic, human and social factors which impact on the effectiveness of a project and therefore, influence the economic outputs and inputs of the project. This does not mean to infer that implementation analysis should be seen as a separate and different form of analysis from the normal economic evaluation of a project or program. Ideally, all evaluation studies should include an implementation analysis as well as the more routine cost/benefit/effectiveness framework and the study of distributional impacts of projects through techniques such as the planning balance sheet approach, interest group analysis, and group impact tables. In the past many evaluation studies have focussed too narrowly on the expected or real economic results of a program, and have neglected the analysis of how the results are to be achieved, or why the achieved level of impacts differed from the planned/expected level of costs and benefits.

SOME BASIC CATEGORIES OF IMPLEMENTATION PROBLEMS

Programs can malfunction or fail for a large number of reasons. It is useful to categorise the main sources of program malfunction in order that a check list process can be undertaken when carrying out an implementation analysis of a new proposed project. In the initial implementation planning process it is useful to carry out a series of checks in order to identify possible causes of program failure so that corrective steps can be taken to reduce the incidence of these events or activities occurring. This check list process is a learning by experience process, by which new programs are checked to see that they do not contain the seeds of program failure which experience has shown has led to malfunctions in other related or similar programs.

Implementation problems can be categorised into four groupings:

1. Problems related to the nature of the political decision-making process.
2. Problems related to the nature of the government agency responsible for implementing the project.
3. Problems related to inter-department and inter-governmental relationships.
4. Problems related to the target group of the program.

Problems Related to the Nature of the Political Decision-Making Process

The first group of problems is related to the political decision-making process and includes:

1. Problems related to the hasty introduction of programs without sufficient planning.
2. Sudden changes and modifications to existing programs creating disruption problems and lack of continuity.
3. Problems related to the failure by government to specify program objectives.
4. Problems related to the imposition of resource cut-backs on existing programs.
5. The short life of governments necessitates the speedy implementation of programs.

Problems Related to the Implementing Agency or Department

The second group of problems relates to the implementing agency and includes:

1. Lack of resources to implement the programs.
2. Unrealistic expectations by management.
3. Poor quality of leadership.
4. Reluctance to delegate responsibility for detailed implementation decisions to lower echelon staff.
5. Poor communication between divisions and agencies.
6. Lack of information on the needs and aspirations of the target group or groups.
7. Absence of a monitoring system to provide information on implementation progress and causes of implementation problems.
8. Failure to develop administrative guidelines and manuals.
9. Failure to inform staff of program goals and objectives.
10. Excessive clearance points within the organization.
11. Conflicting attitudes and motivation by staff towards programs.
12. Failure to identify choke points in a new program i.e. the point at which previously unanticipated problems are likely to occur.
13. Lack of special training for staff for new tasks associated with a program.
14. Failure to identify industrial relations issues related to a new program.
15. Failure to consult with other interested bodies involved in the program.
16. Resistance to change in the implementing organization.
17. Inadequate skilled manpower or lack of competent staff.
18. Ineffective control system or management information system.
19. Lack of effective implementation planning.

Problems Relating to Inter-Department and Inter-Government Relationships

The third group of problems stems from relationships between different levels of government, and relationships between different government departments. These include:

1. Excessive clearance points.
2. Duplication of Administration.
3. Communication delays.
4. Legal delays.
5. The attachment of differing priorities to programs by different departments.
6. Delays in obtaining building approval from a wide variety of state, semi-government and local government authorities.
7. Lack of co-operation.

Problems Related to the Target Group

The final group of problems concerns the target group. These include:

1. Misdirection of funds to the wrong target group.
2. Lack of access by the target group to the program.
3. Lack of understanding by the target group of program entitlements.
4. Lack of information on the nature of the target group.

THE BENEFITS OF IMPLEMENTATION ANALYSIS

Implementation analysis is preventative rather than curative. The intelligent anticipation of problems prior to the commencement of a program will avoid waste of resources, and will go a long way towards ensuring the success of the program in terms of cost containment, output achievement, the meeting of target dates, and the effective delivery of the program to the relevant target group.

SOME IMPLEMENTATION PROBLEMS OF THE PORT KEMBLA COAL LOADER

In June 1977, the Premier of New South Wales announced that a new coal loader would be built at Port Kembla to handle increased coal exports from the Western and South-Western fields. In March, 1978, the New South Wales Cabinet established a Task Force "to guide and draw together the numerous detailed investigations required to

develop an overall long term strategy for the export of New South Wales coal, covering exploration, mining, transportation, port loading facilities, employment, environmental, social and any other basic planning factors" (Coal Export Strategy Study, 1979, p. 1). The Task Force Report concluded that there was adequate capacity in existing rail links to deliver coal to Stage 1 of the new coal loader at Port Kembla provided that in the future longer trains were used and loaded running speed was raised from 50km/h to 80 km/h. It also forecast that Stage 1 would be completed by 1982 (Coal Export Strategy Study, 1979, p. 42).

In order to handle the projected rail movements of coal to Port Kembla as from 1982[1], the State Rail Authority will need to successfully implement a new system of coal transport based on the operation of 3,125 gross tonne unit coal trains with a maximum speed of 80km/h[2]. This will involve the selection, testing and procurement of additional locomotives, the upgrading of track and signalling systems, the probable construction of a new tunnel at Coalcliff, the reaching of agreements with unions on manning levels, timetables and pay rates for bigger coal trains, the provision of design, technical and construction teams for the electrification of the Waterfall-Port Kembla line,[3] and the anticipation of problems which may arise in moving heavy volumes of coal traffic through a suburban rail system.

However, we know of no master plan within the State Rail Authority which integrates and co-ordinates all these elements, and which also identifies potential implementation problems. The Bureau of Transport Economics also expressed some misgivings on this score last year. According to the Bureau: "Barriers to increasing capacity on the Sydney to Port Kembla line still exist. There is a high level of passenger traffic and restrictions are imposed on a single track section through a tunnel between Clifton and Scarborough. Additional paths for freight or coal trains during peak periods are prohibited by congestion, while the single track tunnel is a constant bottleneck to

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1. Export coal traffic on the Illawarra line from the Western and South Western coal fields is forecast to reach 16.7 million tonnes per annum by 1985. A further 3.0 million tonnes per annum is to be hauled on the line from the Southern Coal fields at Coalcliff and Bellambi. (Transmark, 1979, map 2).

2. At present the State Rail Authority is operating 1,825 gross tonne trains with a maximum speed of 50km/h.

3. The Federal Minister for Transport (Mr Hunt) announced on 8th July, 1980, that the Commonwealth Government would support the New South Wales proposal to electrify and upgrade the Waterfall-Port Kembla railway. The project is estimated to cost $181.5 million at 1980 prices, and is expected to be completed in 1984 (Department of Transport, 1980).

efficient train scheduling. Finally, because of the limited stockpile at the Port Kembla loader, trains require extensive shunting to unload wagons.... In addition to rail link difficulties, the Balmain and Port Kembla coal loaders have limited excess capacity. Although expansion of these facilities has been foreshadowed, the State Government does not appear to have any definite plans as yet. It therefore, seems doubtful that the Port Kembla facility will be constructed and operational before the expected start of market expansion in the early 1980's." (1979, pp. 63-4)

Our concern about potential implementation problems with the development and operation of the new system of export coal traffic to Port Kembla have been reinforced by the findings of a study by Rendels Economics (1979), and by the results of a questionnaire which we sent to coal industry executives. These are discussed in the next two sections of the paper.

PROBLEMS FORESEEN BY CONSULTANTS

In August 1979, Rendels Economics were asked by Clutha Development Pty Ltd to comment on the ability of the Public Transport Commission to handle the estimated coal export tonnages up to 1985 and for the next ten years. The Consultants concluded that the coal producers were justified in their concern that the PTC may not be able to move the 20 million tonnes required by rail in 1985, because:

"a. the design, technical and construction teams of the PTC required for the increasing of capacity appear to be extensively committed on other work and the necessary resources of manpower will not be made available for this development,

b. securing Governmental authority for the sizeable expenditures planned in the overall strategy for the evacuation of coal from NSW ($146 million for locos, $77 million for wagons and brake vans, $28 million on track improvements and $23 million on signalling) will take time and may not be easy,

c. decisions on policy matters such as the choice of electric or diesel traction, the design standards of the wagons and the nature of the signalling to be adopted have not yet been taken and procurement of the necessary equipment takes time,

d. the new investments have to be accompanied by radically new techniques of operation. There

> is little evidence that this is understood by those responsible for the day to day train running. Implementation of the necessary new disciplines and motivation will take time." (1979, para. 2.1)

The consultants also went on to add: "The placing of orders for locomotives is critical. Even if completed by the beginning of 1980 there would still be substantial shortfalls in rail capacity.... Co-operation from the railway unions is critical and negotiations on implementing the new operation with bigger trains need to be started so that agreement can be reached quickly. An extra 500 trainmen are estimated to be required and arrangements should be made for higher productivity. Without the co-operation of the trade unions rail capacity would be severely limited." (1979, para. 2.3, 2.5)

We understand from discussions with coal industry executives that the State Rail Authority has agreed to appoint a project manager to supervise the tendering and supply of new locomotives for export coal operations in 1982. However, we feel that it would be more desirable to appoint a project manager to co-ordinate all aspects of the new system of railing coal export traffic to Port Kembla, and to anticipate all the detailed problems of construction and operation.

The list of potential problems identified in the Rendels Economics report is by no means exhaustive. Other possible problems associated with the development and opeation of heavy coal trains to Port Kembla also need to be examined.

For instance, implementation problems may arise if the maintenance procedures of the State Rail Authority are not upgraded. We have been informed by coal industry executives that the State Rail Authority intends to update a number of locomotives which have reached the end of their working life, as a means of ensuring that sufficient locomotives are available in 1982 for coal export trains. However, this measure will only be successful if maintenance standards are raised to a much higher level. The 1978 annual report of the Public Transport Commission noted that in "the case of locomotives, up to 130 of the 538 units in the fleet were regularly out of service. This figure has been improved somewhat by concentrated maintenance effort to between 100-110 although it is still high and reflects the generally unsatisfactory nature of much of the equipment and the antiquated and unsatisfactory nature of much of the workshop and depot facilities in which to maintain it. The out of service level of the locomotive fleet and the rate of failure in service is believed to be approaching twice the figure of major freight railway operations over-

seas." (Public Transport Commission, 1978, p. 15) Maintenance standards for the new coal wagons also will need to be kept at a very high level, as there appears to be no provision for trackside detectors for hot boxes."[4]

Secondly, implementation problems could arise if steps are not taken to ensure that the drivers of the heavy coal trains are trained to a very high level. A recent report on the problems of moving a coal train at the Pennant Hills railway station tends to suggest that driving skills may be lacking even for conventional coal train (D 18.138, 1980, p. 99) The report notes that now "that the regular operation of 1,800 tonne coal trains has been established from the Lithgow area to Port Waratah via Sydney, some of the difficulties are becoming apparent. It is obvious that the heavy extra traffic will find all the weaknesses in the railway operating system... The lack of suitable coal-loading facilities on Port Jackson or Botany Bay as a result of Government decisions against them, requires haulage to be diverted to Port Waratah and Port Kembla... Consequently, the railway system has tasks placed upon it which were not planned for, nor, it would appear, desirable" (D 18.138, 1980, p. 98)

Thirdly, implementation problems could arise if (as the above extract alleges) there are weak points in the rail system which should be identified. These might include bridges with weight limits, marshalling yards with insufficient space to handle the heavier and longer coal trains, and the employment of relief station masters who have no knowledge of the grades, train working or the interlocking of the points at their new locality (see D 18.138, 1980, p. 100). One possible weakness which appears to require particular attention is the operation of heavy coal trains on the suburban 1.5 K V DC system in Sydney. We understand from electrical engineers that the suburban DC system may not be sufficiently rigid to handle the proposed coal trains on the steep grade between Como and Sutherland. If this proves to be the case (and it could be readily ascertained by a computer simulation), then the State Rail Authority will either have to boost the DC system with extra sub-stations and heavier overhead wire, or reduce the speed and weight of the coal trains. The latter course of action could make it impossible for the Authority to handle the projected coal export traffic as from 1982.

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4. These detectors are used by the private iron ore railways in the North-West of Western Australia, and by a number of American railroads.

IMPLEMENTATION ANALYSIS

PROBABILITY SURVEY

In June 1980 we sent a questionnaire to the marketing and/or export managers of Austen & Butta Ltd, the Bellambi Coal Company Ltd, Clutha Development Pty Ltd and Coalex Pty Ltd, asking them to comment on the probability of the State Rail Authority successfully implementing all the policies required to handle coal exports from the Western and South-Western fields to Port Kembla in 1982 i.e. electrification of the Illawarra line, selection and purchase of new wagons and locomotives, track improvements, signalling upgrading, negotiations with unions on the operation of bigger coal trains (manning levels, timetables, pay rates etc.), and the provision of design, technical and construction teams. Five replies were received. One respondent assessed the probability of successful implementation at 1-10%, one respondent at 21-30%, two respondents at 71-80%, and one at 81-90%. A second question on the questionnaire asked the respondents to list the factors which they felt would mitigate against successful implementation. The respondents listed the following factors: delays in government decision making, delays in supplies/works, insufficient rolling stock and locomotives, restrictions of track on the Illawarra line, union problems, difficulties in the State Rail Authority adjusting to the dramatic growth in coal traffic and limitations which the suburban system may impose on the movement of large quantities of coal. A third question asked the respondents to identify the likely consequences of implementation failure of rail transport policies in 1982. Five respondents predicted that there would be increased diversion of coal traffic to road transport, whilst two respondents predicted that there would also be increased overspill movements by rail to Newcastle.

PRICE OF IMPLEMENTATION FAILURE

If Stage 1 of the new coal loader at Port Kembla is completed in 1982, but implementation problems occur with the new system of railing export coal traffic to the loader, then the coal companies may be forced to divert increased quantities of coal traffic to road transport. Rendels Economics estimate that "at best the railways would fall short of being able to convey some 5 million tonnes over two years if the loader is used to capacity... Further delays to those postulated in the report would make the shortfall even greater." (1979, para. 7.30)

Longworth & McKenzie also have concluded that it "is unlikely that the rail system will be able to carry the quantities of coal necessary, particularly during the early years of the new Port Kembla Coal Loader. If it is not possible to carry sufficient coal to Port Kembla by rail it is probable that additional quantities will be carried by road, and that coal traffic on Mt. Ousley and

Wollongong Roads would then increase to some 3,000 vehicle movements per day - twice existing volumes" (1979, p. 6). Such an increase would involve a considerable cost to the community in the form of noise, exhaust emissions, vibrations, delays to other vehicles, accidents, and pavement damage.

Our concern about the price of implementation failure is perhaps best summed up by a sentence in the State Pollution Control Commission's Environmental Impact Assessment of the Port Kembla coal loader. According to the Assessment, "it would be environmentally intolerable for periodic overflows of coal from rail on to road transport to occur in sudden and substantial surges through sensitive areas". (1978, p. 67)

CONCLUSION

There is an urgent need for implementation planning to be applied to the proposed new rail system for transporting export coal traffic to Port Kembla. If implementation problems occur, which could have been anticipated at this stage, then the community may pay a substantial price through the diversion of increased coal traffic to road transport.

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